

**ORGANIZATIONAL INFLUENCES  
ON DIABETES RELATED  
HOSPITALIZATION**

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By  
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*"From disease I have learned much  
which life could never have taught  
me in any other way"*

**Goethe**

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## ABSTRACT

This thesis develops the concept of managerialism in health care through the investigation of patterns of diabetes related hospitalization. It is argued that individual health care behaviour is conditioned by the organizational and societal frameworks in which care is sought and used. Two dominant themes are investigated: firstly, the applicability of Roemer's Law of supply induced demand in explaining area variations in hospital use; and secondly, organizational influences on hospital utilization via doctor gate-keeping functions and interaction between available health services. These are respectively studied at the regional and local levels.

These themes are explored through a case study of the disorder *Diabetes Mellitus*. Diabetes is a chronic health problem which through its complications leads to increased levels of morbidity and premature death. The philosophy of diabetes care and the allocation and organization of resources to diabetes are identified, and a methodology for measuring diabetes related hospitalization developed.

Considerable variation was found to occur between regional hospital board populations in their rates of hospitalization for diabetes. Positive relationships were observed between per capita rates of diabetes hospitalization and area hospital bed supplies, even after controlling for differences in socio-demographic characteristics of the

area populations. These results confirm the existence of Roemer's Law in diabetes hospitalization.

The impact of the organization of health services on patterns of hospitalization at the local level was examined through the establishment of the population based Canterbury Register of Insulin-Treated Diabetic (ITDM) Persons. This provided essential epidemiological data and facilitated the measurement of hospitalization of this diabetic population over the three year period 1 January 1984 to 31 December 1986.

Considerable heterogeneity was observed in the characteristics of the ITDM individuals admitted to hospital during the study period. Admission spanned all age groups and durations of diabetes. Hospitalization was prompted by a spectrum of conditions with a significant proportion being caused by the potentially preventable acute disorders of diabetes control.

Hospital utilization by the Canterbury ITDM population was mediated through the referral system operating between primary care, community based diabetes educational, specialist diabetes outpatient clinical, and hospital inpatient services. General practitioners were the main gatekeepers to care. Patterns of hospitalization varied by individual patient characteristics, general practitioner characteristics, and patient attendance at specialist ambulatory diabetes services.



# CHAPTER ONE

## INTRODUCTION

This thesis examines the socio-medical phenomenon of hospital utilization with specific reference to the disorder *Diabetes Mellitus*. The discipline of geography through its synthesis of people, place and time, offers a powerful approach to the investigation and explanation of health related issues. Medical geography has traditionally focused on the spatial characteristics of the distribution and causation of disease, but geographic perspectives have increasingly been applied to the field of health care. Geography now plays a valuable role in the understanding of patterns of health care provision and health services utilization.

This thesis reflects popular disquiet and State concern with the performance of New Zealand's health system. Standards of health of New Zealanders have deteriorated relative to the populations of many of the Organization for Economic Co-operation and Development countries (OECD) over the last twenty years (Hyslop et al, 1983). Problems in the delivery and use of health care are not unique to New Zealand but are shared by most countries even though different types of health care systems are in operation.

## 1.1 ISSUES IN HEALTH CARE

A financial crisis in the provision of health services is only one of a number of major problems existing in modern health care systems. There are also significant social and spatial inequities in the availability, accessibility and utilization of health services (see for example, Hart, 1971; Barnett et al, 1980; DHSS-The Black Report, 1980; Davis, 1981; Whitelegg, 1982; Joseph and Phillips, 1984; Malcolm, 1987). Some health services are inefficient and others are ineffective (Cochrane, 1972; Health Benefits Review, 1986; Report of the Hospital and Related Services Taskforce, 1988).

A most striking paradox in health care today, is that countries' investments in modern health services have yielded poor returns to improvements in the health of their populations (Powles, 1973; McKinlay and McKinlay, 1977). New Zealand, like most industrial countries, devotes a large proportion of its national resources to health care. In 1987, 7.4% of New Zealand's Gross Domestic Product (GDP) was spent on health, 80% of which was financed directly from the public purse. However, additional expenditure in recent years on sophisticated, high technological and expensive health services has not been matched by significant improvements in health outcomes. The escalation in the cost of health care in the primary and secondary care sectors in both free market and State controlled health care systems is well recognized. There is little doubt that the provision of health care is an expensive exercise, but it would now appear that current patterns of resource allocation are not necessarily the most efficient or effective way of delivering health care.

Inadequacies in modern health care systems reflect three general issues: the derivation of health care intervention, shifts in the burden of disease, and a misinterpretation of what determines health. Modern health care systems stem from the medical model of health. Health services reflect the adoption and institutionalization of the 'scientific' paradigm of medicine, a mechanistic or engineering approach to human health (McKeown, 1979). Health services have typically adhered to the doctrine of specific aetiology of disease and illness, are based on therapeutic and curative intervention (chemically and physically), have promoted individualism and depersonalization of those people receiving care, and have fostered the institutionalization of care (Navarro, 1978; Kelman, 1975).

The changing spectrum of disease throughout this century has seen chronic health disorders, that require long term health management, become the major health problems of developed societies. Infectious diseases have virtually disappeared but they have been replaced by heart disease, cancer, diabetes, asthma, arthritis, alcoholism, drug and tobacco addiction, and eating disorders for example. None of these disorders is communicable. All stem from the contemporary social and physical environment. New Zealand's health problems, today, are principally those associated with its ageing population and with its affluent lifestyle.

In general, health services are not well attuned to people's health needs. The distribution of health care resources is overwhelmingly weighted towards the more expensive secondary care sector where demand has been expressed. A significant

proportion of health problems do not, however, lend themselves to hospital, or current medical, practices. Chronic health problems which account for most morbidity, are the illnesses which impact on everyday life but which are neither rare nor usually life threatening in the short term. Orthodox medicine is least able to adequately treat or prevent these problems (Powles, 1973).

Modern health care systems have not responded well to the shift in disease burden partly because they rest on erroneous assumptions about the causation of health and what are appropriate forms of health care intervention (McKeown, 1979). Scientific medicine isolates individuals from the social context in which the majority of ill-health is created. Populations owe their health standards largely to socio-physical ecological relationships, that is, to their interaction with perhaps an inherently hostile physical environment and with the social, political and economic structures of society. While health is an outcome of biological, environmental, and lifestyle factors (Lalonde, 1974), industrial countries have concentrated their efforts, and placed their faith, in 'high tech' medical methods. Society's investment of resources in health services and scientific medicine has perhaps been misdirected.

The gap between health services and health needs, and indeed, many of the problems now associated with health care, arise directly from the nature of health service provision, and in particular, from the persistence of organizational and professional control over the deployment of health care resources. The health care system is a social institution which is able to be used to manipulate individual

behaviour for professional, organizational and socio-structural purposes (Freidson, 1970; Alford, 1975; Navarro, 1978).

Rates of health services utilization are known to vary widely. Health care systems discriminate against a variety of social groups through inequitable spatial distributions of resources, differential abilities of individuals to pay for care, organizational inaccessibility, and social alienation. New Zealand's health system has been criticized for being unwieldy and unresponsive to consumer needs. It appears to be provider driven, and often lacks consumer choice, acceptability and accountability.

The continuing dominance of the medical profession over the nature and provision of health care is perhaps the singularly most important structuring element in the health care system. Doctors have a professional monopoly over the diagnosis, legitimation and treatment of illness. Medical practitioners are the day-to-day managers of patient care. They are the gatekeepers to services, regulating consumer needs, and patient access to and the use of health facilities.

Problems arise from the interaction and conflict that exists between the different service interests operating within the health care system. In New Zealand, as elsewhere, there have been calls for increased funding of community and primary care by those who see the community as an alternative, and at times, better location for care than the traditional institutional setting. However, the dominance of the hospital sector has been sustained by its political and economic power and control over health policy and allocative mechanisms.

Consumer demand for expensive hospital resources has been perpetuated by a professionally promoted image of the large city hospital as a place of medical excellence, specialized and competent medical staff, and sophisticated and high technological services.

The development of the health care sector in western society is consistent with capitalist economic growth and social formation. The health sector commands large quantities of resources, provides opportunity for profit accumulation and has created a set of public expectations that ensures its survival. The medicalization of individual needs and society's addictive dependence on medical care are serious social issues in the continuing provision of health care.

The modern capitalist State has increasingly been drawn into areas of health and social expenditure. In New Zealand, the State became the dominant funder and provider of health care during a period of social reform by the First Labour Government after World War II. Central Government is directly responsible for the majority of hospital and secondary care services and subsidizes the privatized primary care sector.

Public hospitals are the traditional centre-piece of New Zealand's health system. The public hospital sector captured massive capital investment through the 'uncontrolled' growth of and limitless demand for hospital-based services. The proportion of public health expenditure that New Zealand devotes to hospital services is higher than that in most OECD countries. New Zealand public hospitals attract around 70% of government expenditure on health, but the public sector has largely been unaccountable for its productivity.

Fiscal pressures in New Zealand's economy in recent years have forced the Government to critically examine levels of public expenditure in the health field. While the functions, efficiency and accountability of the health sector have come under review (Health Benefits Review, 1986; Report of the Hospital and Related Services Taskforce, 1988), and Government has voiced concern over the state of New Zealand's health system, little reform has been implemented in the face of public outcry and professional opposition to suggested proposals for restructuring. Although most New Zealanders would agree that the health system needs overhauling, the best options for reform remain unclear. Thus, despite mounting fiscal and organizational problems, and calls for change, the public hospital sector has remained intact and has maintained its share of national resources.

## 1.2 WHY STUDY DIABETES ?

This thesis uses the disorder *Diabetes Mellitus* as the case study. Diabetes is an example of the modern disease burden. It is now recognized as a major health problem world-wide. In the last ten years, diabetes has been promoted internationally as a model for health care re-organization. Diabetes is a metabolic disorder characterized by elevated blood glucose concentrations (hyperglycaemia). The aetiology of diabetes reflects biological, environmental and lifestyle factors. Current theory suggests people inherit a genetic predisposition towards the disorder which is unmasked by ageing, diet, physical inactivity, obesity, stress, pregnancy, viral infections, environmental toxins, and diabetogenic

drugs. Diabetes cannot, for all intents and purposes, be cured but physiological disturbances can be controlled with varying degrees of success.

In 1987, the Medical Research Council of New Zealand identified diabetes as a priority disorder. Only in the last few years has the impact of diabetes on health and resource use been appreciated. As a chronic insidious disorder, diabetes has attracted little public or political attention. However, over 100,000 New Zealanders have diabetes (Neal and Beaven, 1988). The prevalence of the disorder increases markedly with age, and since New Zealand's population is ageing, many more people are likely to develop it in the future. The prevalence of diabetes is also three-four times higher in New Zealand's Polynesian population than in New Zealanders of European descent (Prior and Tasman-Jones, 1981; Stanhope and Prior, 1980).

The health consequences of untreated and poorly controlled diabetes are severe. Diabetic complications involve major cellular, vascular and neural damage. Diabetic individuals are, for example, at increased risk of heart attacks, strokes, lower limb amputations, blindness, and renal failure (Andersen, 1983; Rand et al, 1985; Kennedy and Baynes, 1984; Most and Sinnock, 1983; WHO Study Group on Diabetes, 1985; WHO Multinational Study of Vascular Diseases, 1985). Mortality in maturity onset cases is twice as high as that for the non-diabetic population and for youth onset up to 20 times (Deckert et al, 1978; West, 1978; Dorman et al, 1984; Panzram, 1987). Appropriate forms of health care must be provided



if such health consequences are to be minimized, and the social and economic costs incurred reduced.

Diabetic individuals are major users of health services. Approximately \$80-100 million is spent each year in New Zealand on the hospitalization of diabetic persons, and at least the same amount again on ambulatory and community care (Neal and Beaven, 1988). Diabetic persons are hospitalized more frequently than non-diabetic individuals and duration of hospital stay is much longer (Brown et al, 1985). A significant proportion of hospital admissions are potentially preventable through appropriate intervention in the community. In New Zealand, diabetes care is provided within the overall context of the health care system. Services provided to diabetes care are very fragmented.

Diabetes has provided a model for health services re-organization. The international philosophy of diabetes care is one of patient education, behavioural modification, and individual responsibility in its day-to-day management. Such an approach appears to provide a realistic opportunity for minimizing the acute and long term complications of the disorder, and requirements for hospitalization. It may facilitate major cost-savings and greater efficiency in diabetes services. A health care model that promotes self-care principles and health maintenance in the community has wide applicability to the care of chronic disorders.

### **1.3 THESIS AIMS AND FORMAT**

This thesis has two broad interactive aims: the first is to advance the conceptual understanding of health care systems and in particular the phenomenon of hospital utilization; and the second is to investigate the organization of diabetes care and health outcomes of diabetic individuals in terms of their use of hospital inpatient resources.

This research attempts to fill a significant gap in the explanation of patterns of hospital use. Variations in health services utilization have traditionally been explained in terms of differences in individual characteristics and individual behavioural processes. However, many of the problems evident in the health sector today, are the direct outcome of the organization and ideology underlying the provision of health services. This thesis argues that individual health-related behaviour is conditioned and constrained by the health care system. The satisfaction of health needs occurs within wider social, economic and political relations of society. It is argued that patterns of health services accessibility and utilization are determined largely by the allocation, distribution and organization of health care resources. It is hypothesized that features inherent in the provision of diabetes care are major determinants of diabetes related hospitalization.

In the last ten years a body of literature has emerged on the political economy of health care. However, processes underlying local and regional variations in health services use have not been specified. While behavioural approaches at the individual level

continue to dominate research on health, and while radical geographers attempt to uncover structural influences, perhaps the key factor in determining geographical contingencies at the local and regional level goes unstudied. This is the health care organization. A main contribution of this thesis to geographic endeavour is the conceptualization and empirical investigation of what might conveniently be termed 'health care managerialism'.

The research concentrates on two dominant concepts: supply induced demand; and organizational control of utilization via doctor gatekeeping functions and interaction between health services. Nearly thirty years ago Milton Roemer reported that rates of hospital utilization were positively related to the supply of hospital beds that were available to populations. This was independent of their socio-demographic characteristics (Roemer and Shain, 1959; Roemer, 1961). Despite the significance of this finding, known as Roemer's Law, the concept that the supply of health care resources creates its own demand, has not been extensively explored within the medical geographic literature (or within the health literature as a whole) and has largely been overlooked as a potentially important explanation of observed patterns of health services use.

As New Zealand re-appraises its health service, attention must focus on 'provider' factors and the supposed neutrality of the health care delivery system. Only two studies (Barnett et al, 1980; Malcolm, 1987) have specifically examined the relationship between the availability and utilization of hospital beds in New Zealand, in the former case for general beds and the latter for mental handicap beds. This thesis furthers this field of inquiry, not only by adding to an

internationally scarce body of literature but more specifically by investigating hospital utilization with respect to a particular diagnostic entity, namely diabetes mellitus.

In addition, the role played by the health care delivery system is examined at an organizational level and within the local setting. Akin to Pahl's urban managerial thesis (Pahl, 1975; Pahl, 1979B) it is argued that doctors are the managers of the health system and are the gatekeepers to care. Those who control the structure and operation of the health system, control individual access to and use of existent resources. Where there is a hierarchy of health services, as in diabetes care, it is the function of the referral system to mediate between supply and need (Joseph and Phillips, 1984; Berkhout, 1984). The medical profession are the key decision-makers in the hospitalization process. Use of services and resources is at their discretion.

The research adopts a managerialist approach to health care in the context of the wider political economy of health. The thesis investigates the influence of resource availability and the organization of health services on hospital utilization, by drawing on and reconciling these three modes of geographic thought. Each offers particular insights into health care issues, but none provides a complete explanation. Conceptual issues in health and their application to hospital utilization are examined in Chapters Two, Three and Four. The aim of these chapters is to provide a comprehensive understanding of the determinants of hospital utilization and a base for undertaking the empirical research.

The significance of this thesis lies also with its case study. The research presented here, represents the first substantive contribution to the measurement and explanation of diabetes related health services utilization in New Zealand. It provides an alternative and new perspective to the orthodox medical interpretation of diabetes care.

Given the pioneer nature of the work, an important part of the overall purpose of the thesis was to provide essential data on diabetes hitherto unknown. Good information on the epidemiology of diabetes was not available and the impact of the disorder on health services use was not known. While the empirical research was pre-determined by the objectives of investigating supply induced demand and the impact of the organization of diabetes care on diabetes hospitalization, a number of aims specific to diabetes were identified in order to facilitate these objectives. These included:

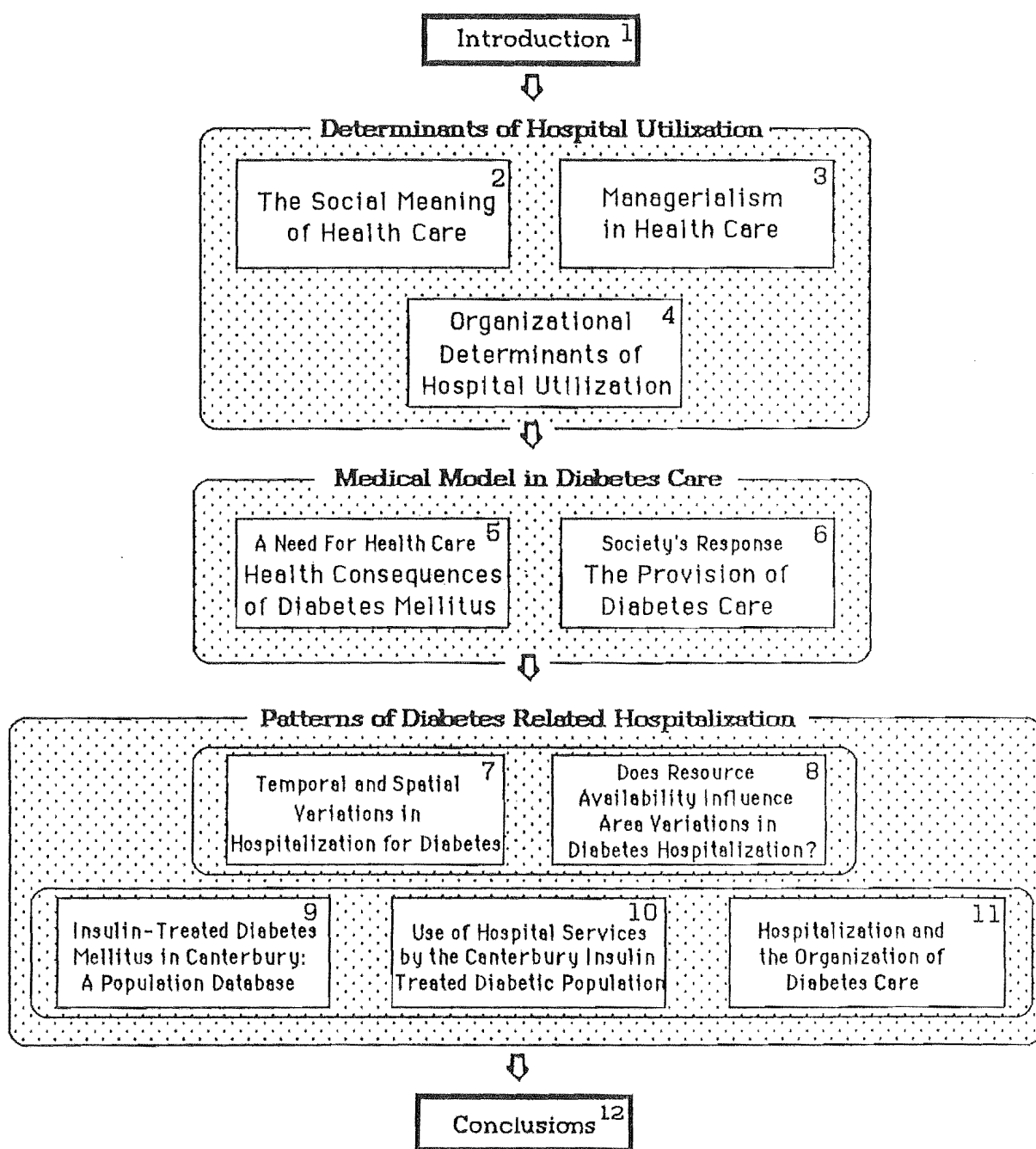
- (1) A review of diabetes as a health problem,
- (2) An interpretation of the philosophy and nature of diabetes care,
- (3) The development of a methodology for measuring diabetes related hospitalization, and
- (4) The development of a population based register of insulin-treated diabetic persons.

True identification of hospitalization of diabetic persons has not been undertaken in New Zealand, nor the evaluation of service provision in promoting efficient and equitable use of health care resources by this sub-population. Through the identification of

patient groups most at risk to hospitalization, and the reasons behind hospital admission, it may be practical to introduce strategies in the short and long terms to improve patient health outcomes and to minimize the requirements for expensive hospital resources.

The format of the thesis is summarized in Figure 1.1. It is structured into three main sections: (1) the conceptualization of the determinants of hospital utilization; (2) the medical model in diabetes care; and (3) variations in diabetes related hospitalization. Section one (Chapters Two to Four) involves the examination of the meaning and role of health care and medicine in society, why health care systems assume the organizational form they do, what forces and conflicts are involved, and their impact on hospital utilization. If patterns of hospital use are to be fully understood, then it is essential to develop an explanation which incorporates societal influences, factors pertaining to the operation and organization of the health services system, and individual or population characteristics. As stated above, the focus of the thesis is the impact of the health services system on area and individual variations in diabetes hospitalization. It is argued that the role and behaviour of the health services system and interaction at the individual level cannot be appreciated without understanding its basic characteristics and functions in society.

Chapters Five and Six then examine diabetes in terms of the medical model of health and health care (identified in Section 1). The function of these two chapters is to provide an explicit example. Diabetes is a complex health disorder. If the empirical work and the application of the conceptual model of hospital determination



**Figure 1.1:** Thesis Format.

forwarded in the preceding chapters are to be fully understood, then it is essential that the intricacies of the disorder with respect to its impact on health and resource use are also understood. Chapter Five therefore provides a discussion of diabetes as a health problem and Chapter Six examines the philosophy of diabetes care and the provision of diabetes services.

The empirical research provided in Section Three involves two levels of analysis and draws on a variety of databases and methods. Chapters Seven and Eight present a macro-level analysis of regional variations in hospital admission patterns for diabetes and the relationship to the availability of health care resources. The aim of these chapters is to investigate the applicability of Roemer's Law to area variations in diabetes hospitalization, that is, to examine supply induced demand. This macro-analysis uses a disease oriented approach based on national admission and discharge data for the 'disease' entity *diabetes mellitus*.

In contrast, the impact of the organization of diabetes care on individual likelihood of hospital admission is identified in the local level analysis presented in Chapters Nine to Eleven. These chapters examine in a unique fashion hospital use by an entire diabetic population. Rather than adopting the disease approach used in the macro-analysis, which has certain problems associated with it in terms of diabetes, the *Insulin Treated Diabetic Population of Canterbury* was identified and hospital use by all members of this population traced over the three year period 1 January 1984 to 31 December 1986. One of the specific objectives of the thesis was to develop a computerized population database of this diabetic



population. This facilitates the examination of patient pathways to care and patterns of hospitalization with respect to both individual and health care organizational determinants.

The thesis is concerned only with utilization of public hospitals. Hospital care for diabetes is predominantly provided within this sector, and it is around public hospitals that much of the current controversy revolves.

## **CHAPTER TWO**

### **THE SOCIAL MEANING OF HEALTH CARE**

#### **2.1 INTRODUCTION**

Society assigns various social and political characteristics and values to health and health care. For example, while individuals find the diagnosis of diabetes traumatic and the community is sympathetic towards their predicament in the short term, diabetes does not draw the same reaction as cancer or A.I.D.S. Yet, each is life threatening. Society interprets and responds to health problems in certain ways. Recognition of the social and political values inherent in 'health' is fundamental to the way in which conflict and inequity are perceived. What is, for example, the meaning of health? Why has the health system developed in the way it has? What are the functions of the medical system and what interests are served by it? What returns have society gained from its investment in medicine?

The aim of this chapter is to address these questions. Health care issues are firmly embedded in the structure and functioning of society. The social meaning of health both conditions and is conditioned by the health care system. If processes of hospital utilization are to be understood, and if society's response to diabetes and the nature of diabetes care are also to be understood, then they must be located within the wider context of the political economy.

This chapter therefore provides a general discussion of the derivation, ideology and role of the medical system within the capitalist environment. Chapter Three then elaborates on issues pertaining more specifically to the medical profession and political interactions within the health care system.

The chapter is divided into three main sections. The medical model of health is examined in Section 2.2. The emergence of the dominant medical ideology of scientific medicine and the medical understanding of health determination are discussed. These underly the definition of health and the nature of the provision of modern medical care today. Section 2.3 provides a review of medicine under capitalism. Explanations of health inequalities and inequities in health services provision need to be sought outside narrowly conceived boundaries of the health care system and placed in the context of the containing society. The aim of this section is therefore to examine structural factors which reflect in the function and character of medical services. Section 2.4 identifies some of the problems that are evident in the development of medical practice in its present form. Despite the enormous investment of resources and trust placed in health services, the contribution of modern medical care to improvements in health outcomes is questionable. Apparent 'paradoxes in health care' are the focus of this section.

## **2.2 THE MEDICAL MODEL OF HEALTH**

### **2.2.1 Medical Ideology and Health Determinants**

The meaning of health and the role of health services are largely taken for granted, but society interprets and values health and medicine in certain ways. Modern medical systems are the product of the adoption and institutionalization of the scientific paradigm of medicine. Modern medicine is founded on a mechanistic or engineering approach to human health. This originates from Renaissance Science in which phenomena were analysed as sets of mechanically related parts (Doyal, 1979).

The 17th century philosopher Descartes derived a model of the human body based on Galilean principles of mechanics. Descartes conceptualized the body as a machine and assumed it would work in much the same way as any other machine that was governed by the laws of physics (McKeown, 1979; Doyal, 1979). Ill-health became defined as deviations from normal biological functioning. Such disturbances were equivalent to breakdowns in machines. If the body acted as a machine then it could be controlled like a machine. It could be taken apart and put back together to restore health. The structure and functioning of the body, and the disease processes that afflicted human bodies, became the domain of the medical profession.

The ascendancy of the germ theory in the late 1800's (Renaud, 1975; McKeown, 1979) strengthened the mechanistic model of medicine. Scientists like Pasteur rose to prominence in

society and the concept of bacteriological causation of disease was quickly accepted into theoretical and practical medicine. Germ theory promoted a unifactorial model of disease and ill-health. Illness was analysed in terms of localized pathology and malfunctioning which could be explained by the characteristics of discrete and specific disease agents found in the host individual (Freidson, 1970). External symptoms related to internal malfunctioning. Attention tended to focus on individual parts of the body's cellular and biochemical systems.

Scientific medicine has promoted a doctrine of individualism, specific aetiology of disease, and mechanistic intervention. Germ theory reinforced the individualistic nature of medicine not only by concentrating on individual people but by emphasizing specific organs and cells. Bacteriology supported the concept of specific disease therapies on which is based both the curative orientation of modern medical technology and the belief that people are made healthy by means of 'technological fixes' that is, by engineering intervention (Renaud, 1975). As Doyal (1979) identifies, the established nature and boundaries of medicine became curative, interventive (chemically and physically), individualistic, objectifying patients and denying them status as social beings.

The evolution of scientific medical thought is reflected by the development of specialty fields in medicine, especially anatomy, physiology, pathology and diagnostics, all of which continue to dominate the practice of medicine. There can be little doubt over the continued presence of the mechanistic model with present research interest in furthering knowledge at both the cellular and

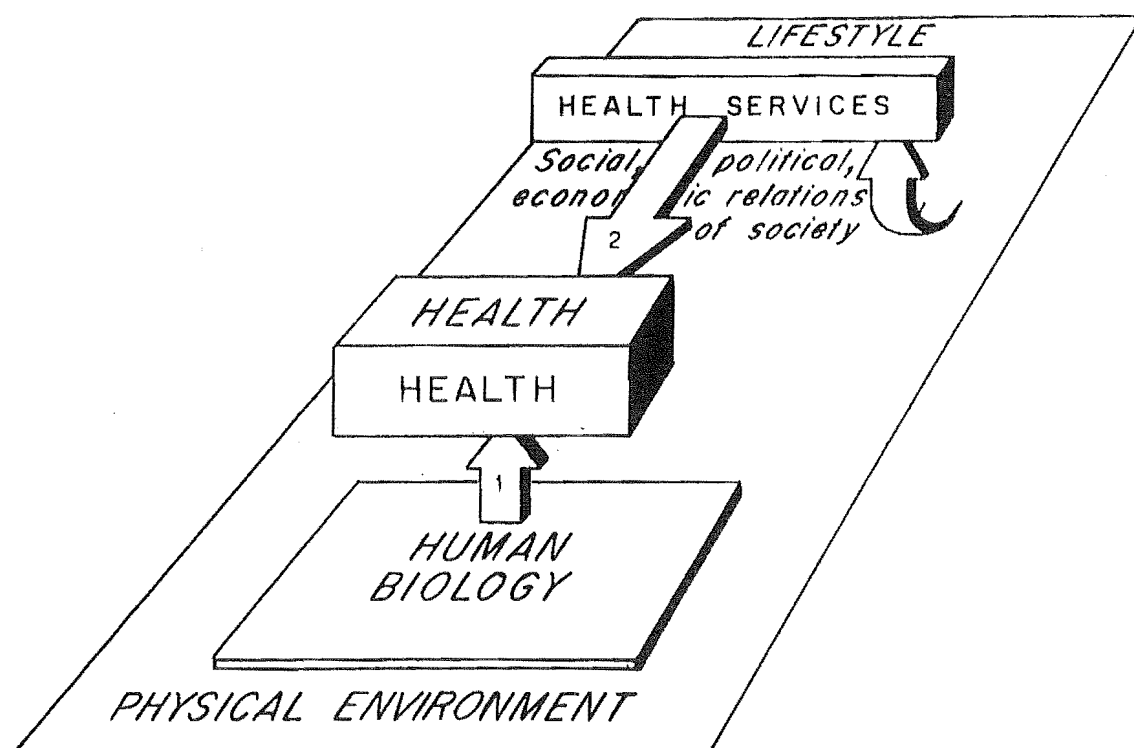
molecular levels. The implementation of the scientific medical paradigm was officially marked in North America with the release of the 1910 Flexner Report on medical education in the United States and Canada (Berliner, 1975). This document advocated the institutionalization of scientific medicine through the establishment of recognized medical schools in universities and teaching hospitals. Such a system of medical education was already in operation in Britain, the structure around which New Zealand based its medical training. The academic strengthening of medical research and education merely reinforced the prevailing ideology of the early 1900's.

Through the historical development of medical ideology many ideas and beliefs have become firmly entrenched in medical thinking and practice. As stated above there are reductionist assumptions in scientific medicine that focus attention onto the individual. Illness is a problem of individual human beings. Even though government intervention does occur in some areas of environmental and occupational health, the responsibility for health and cure of ill-health primarily rests with the individual and not at the collective level. Attempts at explanation of aetiology and specification of treatment indicate where responsibility for health lies. "By definition scientific medicine rejected the idea of social causality of disease or illness, since the social basis of humanity was placed outside the realm of what was considered scientific" (Berliner, 1975). This is perhaps no longer true of contemporary medical thinking but intervention still largely remains at a biological level and not at the economic or social.

Because medicine is assumed to be a science, it assumes the neutrality and values accorded to scientific pursuits. Use of the scientific method has allowed medical scientists and practitioners to take an objective and neutral stance towards their subject matter. It has also promoted the belief that medicine facilitates rational control of people and their health problems. The relationship between medicine, health and society is such that scientific medicine has been regarded as the only viable means to mediate between people and disease (Waltzkin, 1978; Eyles and Woods 1983; Doyal 1979).

Historically, doctors have become more and more preoccupied with finding better and better ways of intervening in people's health. Patients have subtly been relegated to the role of hosting pathogens, which by medical definition require intervention by trained doctors. Western countries have concentrated their health improvement efforts through medical intervention via the provision of health services. Health care systems are dominated by an image of the large acute city hospital, with an entourage of specialty departments and high technological resources.

Health services are, however, only one and probably the least important determinant of health (Powles, 1973, Lalonde, 1974; McKinlay and McKinlay, 1977). Figure 2.1. presents a model of the determinants of health. Health (however defined) is conceptualized as the outcome of the interaction occurring between four basic determinants: human biology, the physical environment, lifestyle and the health services system (Lalonde, 1974). Essentially, the biological characteristics of people are superimposed on an



**Figure 2.1:** Determinants of Health.



environmental plane defined by people's physical and social habitats. Health services, reflecting the basic relations of society, are provided in response to this interaction.

The medical model of health concentrates on the net effect of the interaction of the physical rather than the social environment on human biology (arrow 1). Health outcomes are a function of the ability of therapeutic practices and scientific techniques available in the health services system to deal with the given pathogens (arrow 2). This approach has isolated individuals from the social and physical contexts engendering ill-health. It has "led to an indifference to the external influences and personal behaviour which are predominate determinants of health. It has also resulted in the relative neglect of the majority of sick people who provide no scope for internal measures which are at the centre of medical interest" (McKeown, 1979, pXVI).

The adoption and persistence of the paradigm of scientific medicine created the situation where other strands of thought relevant to current health issues (e.g. medical ecology, population sciences, historical demography) were largely excluded from medical theory and medical practices. The alternative ecological perspective, sought explanations of ill-health within the physical, economic and social systems in which people live. Emphasis is given to prevention rather than treatment, and to collective levels of health as well as individual well-being.

This perspective is not new. Indeed, Hippocrates, the 'father of medicine', while advocating objective observation and deductive

reasoning in medicine, believed in the importance of both diet and hygiene (Levey and Greenhall, 1987). In the 1800's, Rudolf Virchow in his early Marxist writings on health, advocated increased attention to the social causation of illness and disease (Waitzkin, 1978). However, his views ran counter to the emerging scientific paradigm and were never accepted into society.

Only in more recent years has the medical system acknowledged the importance of environmental and lifestyle issues in health fields other than in the traditional areas of public health. As Lalonde, once Canada's Minister of National Health and Welfare, commented, this in itself is a radical step given the clear pre-eminence that the health care organization has had in past concepts of health (Lalonde, 1974). However, while health is being promulgated as a factor of lifestyle, intervention is still located within the medical model. "While it is to changes with which the ecological approach is concerned that industrial society largely owes its current standard of health, it is in the mechanistic approach that society has placed its faith" (Powles, 1973, p15).

### **2.2.2 The Meaning of Health**

Health care systems face major problems today because health and health care intervention reflect a medical interpretation. There is a varied set of health concepts operating in society at any given point in time. Health services adopt certain objectives and forms consistent with their basic ideology, but different interpretations of health may imply quite different service requirements and may reveal marked deficiencies in existing service provision.

Health concepts are essentially socially derived. The meaning of health has become increasingly politicized with concepts changing from pure functional definitions to issues of welfare and social alienation. As noted by Eyles and Woods (1983), in Victorian times, health represented the lack of physical disability and absence of disease. As long as people could undertake physical work and function satisfactorily, they were deemed to be healthy. Today, ill-health is regarded as a state of social deprivation. The most widely promulgated contemporary definition of health is that provided in the constitution of the World Health Organization (WHO). Health is defined as a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity.

Kelman (1975) suggests that in capitalist societies there is an inherent social contradiction in the meaning of health between the two fundamental dimensions of functional and experiential health. This reflects the continual conflict within capitalism between the processes of profit accumulation and social development. As in the Victorian example, functional health represents the state of optimum capacity of an individual to effectively do productive work and perform the roles and tasks for which she/he has been socialized (Kelman, 1975). This is most consistent with, or least disruptive, to capital accumulation. This view implies a health care system that will administer and take care of health problems but one that does not eliminate the basic stressors or causes of ill-health.

Experiential health represents an individual's own perception of what it is to be healthy which may differ substantially from

objectively or socially defined interpretations. It is more intrinsic to the individual, reflecting the absence of illness and disease but also freedom from social alienation. Health, according to Kelman (1975), is nothing more than the prevailing stand off between the tendency for capitalism to reduce populations to the status of resources employed for its expansion and the tendency of people to seek self-fulfilment. From this perspective, improvement in health requires policies that ameliorate or eliminate the social, political and economic structures of society that give rise to ill-health.

In contrast, the traditional sociological approach to health, as advocated by Parsons (1952), views illness as a form of social deviance and thus as a problem of social control. People who are ill are labelled deviant since their behaviour fails to apply to a system of authoritative norms to which adherence is expected (Gerson, 1976). When people are unwell or disabled, they adopt a socially defined 'sick role' which is characterized by four role expectations: (1) sick persons are not held responsible for their incapacity, their undesired or unexpected behaviour is due to 'natural' causes; (2) they are exempted from their usual role and are relieved of their everyday responsibilities and tasks; (3) they must want to return to normality i.e. leave the sick role; and (4) sick persons are expected to seek competent medical help and comply with medical advice and treatment (Freidson, 1970; Robinson, 1971; Waitzkin and Waterman, 1976).

As Gerson (1976) states, a fundamental flaw of the Parsonian conceptualization is the assumption that the interests of physicians and patients are harmonious, if not congruent, but the patient-doctor

relationship is fraught with contradictions. In addition, the generalized notion of the sick role has little relevance to much of the behaviour surrounding ill-health, particularly with reference to illness which is not sufficiently severe to warrant formal medical attention, and to long term and incurable chronic illness which requires on-going management.

The Parsonian perspective assumes that medical personnel are both technically competent and sincerely dedicated to the relief of suffering and cure of illness (Gerson, 1976). However, doctors logically become the agents of social control, since the adoption of the sick role requires for its legitimation the seeking of professional help. Doctors are "the gatekeepers who regulate access to the sick role...Essentially physicians are responsible for 'certifying' illness... The physician permits limited deviance for individuals who experience strain in their customary roles. In certifying illness, doctors often deflect attention from the basic injustices and material grievances which trouble patients in everyday life" (Waitzkin and Waterman, 1976, p11-12).

Illich (1974) also argues that society transferred to physicians the exclusive right to decide what constitutes sickness, who is sick or might become sick, and what shall be done with such people. Illich states that this dependency on the medical profession for both the definition and treatment of illness has actually expropriated health from the people. Medical care has become an integral and highly desired part of social consumption in modern society.

## **2.3 MEDICINE UNDER CAPITALISM**

Having identified the ideology underlying medicine and some of the values and meanings society assigns to health, this section examines Marxist interpretations of health care under capitalism. It is believed, similar to the views espoused by proponents of the political economy approach to health care, that the understanding of the true nature of the development and manifestation of issues in health, requires an understanding of the macro-dynamics of the containing society. Political analyses of health care have in the past regarded the forces and actors within the medical sector to be the main determinants of everyday realities. While, this thesis argues that factors within the health care system are of great importance, and these are discussed in the next chapter, it also recognizes their interdependence with the wider social, political and economic relations of society.

### **2.3.1 Marxist Interpretations of Medicine**

Marxist theories basically seek to relate health care systems to the social, political and economic structures of the societies in which they are located. Navarro (1976, 1978, 1983) argues that medicine is shaped primarily, though not exclusively, by the same forces that determine overall social formation. In Western society, the power structures and distribution of resources in the health sector mirror those in the capitalist system as a whole. Navarro does not believe that the nature of medicine is determined solely by the power position of the medical profession and although factors within

the medical sector are important, it is the forces outside of the sector that dominate.

Marxists believe health care is fundamentally determined by the social demands of labour and the social needs of capital. Navarro states; "the primary determinant of medicine is class struggle, a struggle that takes place under the dominance of the bourgeoisie. The knowledge, practice, and institutions of medicine are the synthesis of power relations, of which class relations and struggles are the key" (1983, p189). Health policy and legislation, and features of the health sector represent, at any particular point in time, the outcomes of the struggles between the conflicting classes and the social contradictions that exist under capitalism.

The continuation of capital accumulation requires the renewal of the general conditions of capitalism as well as the means of production. This involves the reproduction of both inputs into the productive processes (forces of production) and the sets of beliefs and relations that hold society together (existing relations of production) (Doyal, 1979). Labour power as a productive force is vitally important to the survival of the capitalist system, and indeed to all systems. The work force must continually be regenerated, but it must remain within the appropriate social and economic relations to capital. Health care reproduces the forces and relations of production by maintaining the labour force in a reasonable state of health, by promoting social integration, and by helping to maintain hegemony which is diffused by social institutions like medicine, education and social welfare into all aspects of life (Eyles and Woods, 1983).

Navarro identifies the dual function of medicine in the following manner, "One, necessary under any mode of production, is to contribute to the care and cure of the (historically and socially determined) health and disease of the collectivity. The other is the control function over the working class and popular masses...These two functions do not exist side by side but, rather, the control function is exerted through the useful function" (1983, p185). The social control function of medicine could not take place unless individuals perceived a need for medicine, and unless health services were seen to be effective in resolving at least partially some of the problems of ill-health. Indeed, Navarro argues that "the main function of medicine in present-day capitalism is not to solve or cure, but to take care of and administer the diswelfare that is created by the social relations of production... it ameliorates and makes palatable the diswelfare created in the sphere of production and consumption" (1978, p91-2). Medicine thus has broader significance as an agency of social control and legitimization of the existing mode of economic organization (Doyal, 1979).

Not only do the health needs of the population come into frequent conflict with the processes of capital accumulation but capitalist industrial growth also creates specific health needs. Class differentials in the impact of ill-health are inextricably linked to commodity production. The requirements of capital accumulation affect health directly by conditioning the physical processes of production. Health risks to workers are imposed through the physical work place, stress from competitive work relations, and indirectly through damage to the environment or through the very nature of the commodity produced for example (Doyal, 1979).



Perhaps more importantly, the forces and relations of commodity production determine the distribution of income which determines standards of living and quality of life.

Renaud (1975) states that health needs are traditionally treated by the medical sector in a way that institutionalizes the solutions to these needs compatible with the capitalist economic system. In other words, at the same time as legitimating capitalism, the medical sector also creates new areas of production for capital accumulation by those owning the means of health care production. The medical sector transforms health needs into discrete commodities for sale and purchase, and often without ensuring that the health status of the consumers will necessarily improve. Modern scientific medicine "equates healing and consumption, that is, health needs and commodity form of their satisfaction, thus legitimating and facilitating capitalist economic growth despite the negative health consequences" (Renaud, 1975). The commodification of medicine represents the transformation of subjective and personal relations into objective and depersonalized exchange relations.

According to Navarro, "The primary controllers and managers of medicine are not the professionals but rather the controllers and managers of Capital...The concept of health and even the nature of medical practice has continuously changed and has been redefined according to the needs of the capitalist modes and relations of production. The medical profession intervenes in that redefinition but *a posteriori* i.e. they administer and influence but do not create the nature of medicine" (1978, p86-7). This is a statement of Navarro's philosophical stand but its application at the level of

everyday realities is questionable. Illich, for example, argues strongly in contrast that the creation of medical dependency and consumption of health resources is the direct result of manipulation by the medical bureaucracy (Illich, 1977). There is little doubt that the medical profession exerts considerable power in defining and controlling medical practice within local, regional and national contexts.

It is clear, however, that prevailing concepts of health have not emerged from a consensus of opinions, but rather, from dominant views of particular sectors within society. In the 1980s, health is seen by some as an individual responsibility, and poor health as an outcome of the lifestyles that individuals have chosen to live. Individuals are expected to help themselves by changing their ways of life and adopting lifestyles conducive to healthy living. Illness is associated with individual moral failings and the victims of ill-health are blamed for their health problems (Doyal, 1979).

Victim-blaming and the incorporation of lifestyle politics into health relieves society of any collective responsibility towards change. Navarro states with respect to the social commentary of American youth on the need for individual choice of lifestyle and self-care, "Far from being a threat to the power structure, this lifestyle politics complements and is easily co-optable by the controllers of the system, and it leaves the economic and political structures of our society unchanged" (1976A, p126). The lifestyle argument according to Waitzkin (1978), perhaps even more than the early emphasis of specific disease causation, masks the real sources of ill-health which

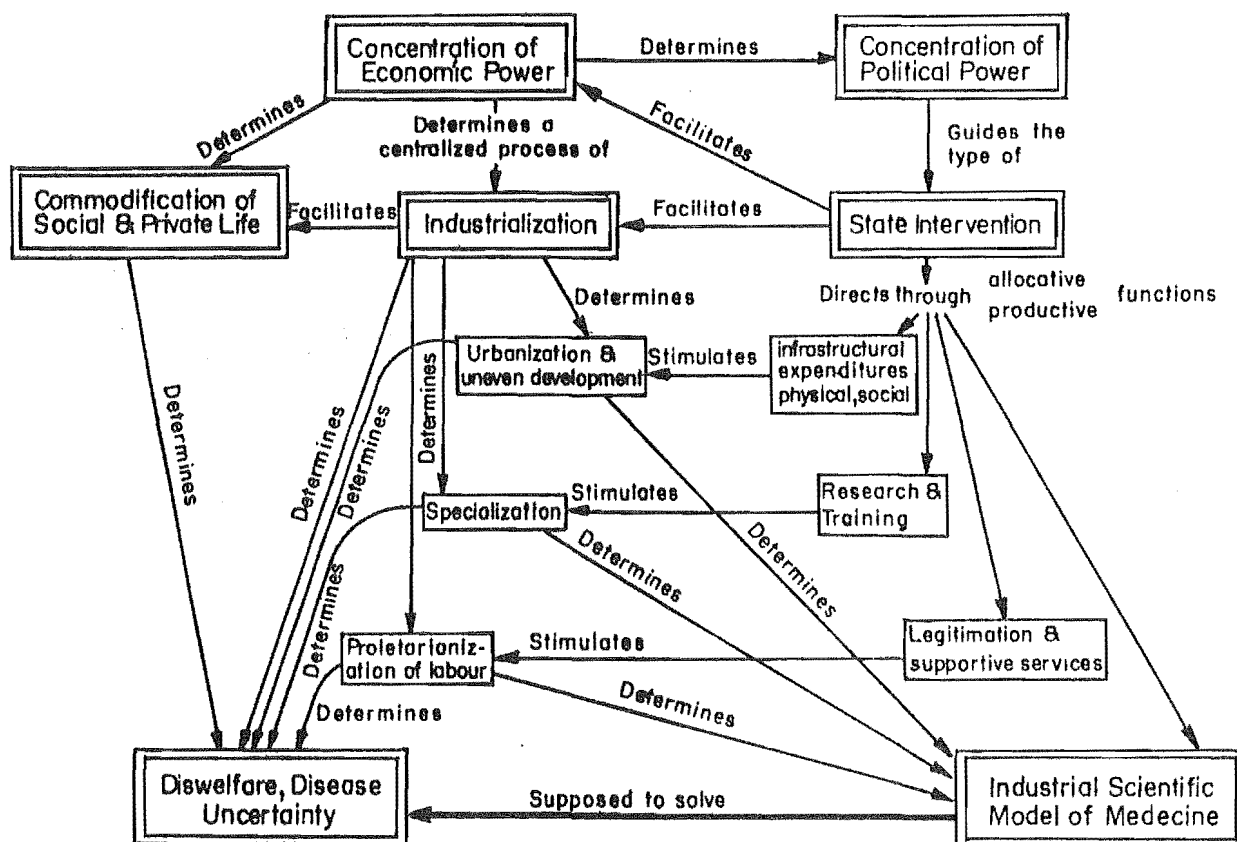
are engendered in the capitalist work process and industrial environment.

The emphasis on individualism and identification of lifestyle causation of ill-health without transferral of medical resources provides a method for diffusing what are potentially explosive social issues (Doyal, 1979). Modern medicine helps to maintain the status quo by convincing the population that what is politically and collectively caused can be individually and therapeutically cured. "Medicine is indeed socially useful to the degree that the majority of people believe and accept the proposition that what are actually politically caused conditions can be individually solved by medical intervention. From the point of view of the capitalist system, this is the actual utility of medicine" (Navarro, 1976A, p208).

### **2.3.2 Summary of the Relationships Between Medicine and Capitalist Development**

The Marxist approach to health, thus, relates the social production and meaning of health, and the derivation of the medical model of medicine, to the basic characteristics of the capitalist mode of production. Navarro (1978; p218) provides a convenient summary of the relationships and forces underlying the development of modern medicine under capitalism (Figure 2.2).

The essential feature of the capitalist mode of production is the concentration of economic power. An increasingly small number of large corporations are assuming greater control over different sectors of the economy. This concentration of economic power



**Figure 2.2:** Relationships Between Medicine and Capitalist Development (After Pahl, 1978).

determines the type of technological and industrial development that is needed to serve and facilitate economic activity. Political power becomes concentrated in the hands of those who own and control the means of production.

Capital accumulation is stimulated and facilitated by the state through its reinforcement of the concentration of economic power and through the processes of industrialization. The state also plays an active role in shaping society and maintaining the basic relations of capitalism via its allocative and productive functions. The role of the state will be discussed in Section 2.3.3.

Populations have become increasingly urbanized as the means of production and consumption and the realization of surplus value have become spatially concentrated. The continuous demand for specialization creates further divisions in the labour force. Processes of urbanization and specialization in the work force, in turn demand greater involvement by the state to guarantee the reproduction of labour.

The process of economic concentration and concomitant pattern of industrialization leads to an invasion of corporate capital into all spheres of social and private life. As commented above, contemporary capitalism, in the search for profits, converts social needs into commodities which can be bought and sold in the market place. This commodification impacts directly on health and overall social well-being.

The basic processes of capitalism also determine the mode of production and distribution of health care. The nature of medicine replicates the basic features of economic production and distribution. The scientific model of medicine is characterized by spatial concentration of health care resources, specialization of the medical work force, a scientific technological orientation, and institutionalization of care.

The fundamental role of the health care system is to minimize the impact of health problems and mitigate the social alienation and welfare problems created through the production process. Navarro states "The nature of medicine, then and its relation to the overall process of production, determine in a large degree its *characteristics*. And its position within that process of production explains its *function*, which is to take care of and solve the unsolvable - the diswelfare and dysfunctions created by that very process of production" (1976B, p452).

### **2.3.3 State Intervention**

State intervention is a factor to be considered in health care systems in all countries. The aim of this section is to look at the State's role in the provision and regulation of health care under capitalism. This requires a basic understanding of the character of the modern state.

O'Connor (1973) identifies three basic functions of the state: social investment; social consumption; and social expenses. Social investment involves the provision of infrastructure, such as roads or

water supply, which is needed by the majority of people but who are unable to provide for themselves. Social consumption, which is of main interest here, includes the provision of services and procedures needed to reproduce the system, and in particular the labour force. These include such things as housing, education or health care. Castells (1977) labels these items as collective consumption. Collective consumption is produced or subsidized by the state because it is essential in maintaining the accumulation process but is generally unprofitable for private capital to provide on a population basis (Taylor and Hadfield, 1982). Social expense represents state expenditure on coercive items relating to social control functions. This includes expenditure on the police or armed forces for example.

Marxist writers hold the view that the state protects and advances the interests of private capital (O'Connor, 1973; Castells, 1977; Dear and Clark, 1978; Leonard, 1982; Ambrose, 1986). The state is subsumed as an element of the capitalist superstructure and its functions are predetermined by the economic base of capitalist development (Dear, 1981). There is, thus, a necessary class bias in its functioning. The state is a condensate of the relation of power between the 'struggling' classes and as such it depicts the confrontation and unstable balance that exists between them (Castells, 1977).

Saunders (1981) identifies three factors that operate to ensure that the state preserves and promotes the interests of capital: (1) various agencies of the state are invariably controlled by members of the ruling classes; (2) the capitalist class as a whole contributes

the single most powerful political interest in society and therefore achieves considerable influence over state policies by exerting pressure from the outside; and (3) because the state ultimately depends for its revenue on continuing capital accumulation in the private sector, its primary function must always be the support of capital.

State intervention has become increasingly necessary to maintain capital accumulation for three reasons: (1) capital, in order to maintain profits, wants the costs of reproducing the labour force minimized and social unrest prevented; (2) the working classes want more and more concessions in return for their labour power; and (3) populations have become increasingly interdependent with the processes of production and distribution (Castells, 1977). There has been a broadening of state intervention into all aspects of life because there has been a need for greater concentration in the provision, organization and management of areas of social consumption like housing, education, health services, social welfare services, public transport and recreational facilities (O'Connor, 1973; Castells, 1977). It is the state, at its various levels, that is largely responsible for providing and managing these items (Harloe, 1977).

While there is no disagreement that the state acts as a supplier of public or social goods, and co-ordinates and regulates the demand for and supply of commodities deemed important by the population, pluralists disagree on the theory of the state and the interests it serves (Ambrose, 1986). The pluralist approach argues that the state is responsive in its policies and actions to external political pressures and varying interests in society. Democratic



electoral processes ensure that the state is essentially neutral in its functions and is autonomous of any particular class interests (Saunders, 1981). The state may undertake a wide range of often conflicting actions, but no single class dominates these actions (Dear, 1981).

Class factions controlling commodities which the state has strong interventionist attitudes towards, can be forced to pursue modes of operations not totally in line with their market principles. Pahl argues 'the state does not primarily serve the interests of a specific faction of the ruling class, that is the dominant economic elite, controlling the central productive processes but rather has a relative autonomy, which sometimes makes it possible to cut into the dominant classes' economic power without ever threatening their political power' (1977, p53-54). Thus, the state facilitates capital accumulation, but it also regulates the distribution of profits derived in the market place (Dear and Clark, 1978).

The pluralist theory of the state argues that the state operates as a neutral arbiter in conflicts arising between competing classes. It functions as a type of 'political market place' in which demand expressed effectively from the community determines the supply of enforceable policies (Saunders, 1981). The state reacts to different political alliances which are formed between individuals and community groups who have responded to particular political issues. The strength of the pluralist theory lies in explaining community power structures, state action and resolution of conflict at the local level. However, the pluralist view of the state has been criticized on the basis that the best articulated political preferences, to which

local or central government responds, are not necessarily indicative of people's needs or real interests (Saunders, 1981). In health care or housing for example, people do not necessarily know what they want, many people do not respond politically to issues with their inactivity being taken as a sign of consent, or the local political agenda and bargaining process is weighted towards the interests of certain groups, the medical profession for example.

Pahl (1977) argues that the modern capitalist state is more aptly described by corporatism in which state power, embodied in the bureaucrats and technocrats, expands at the expense of capital interests. The state develops its own momentum and capacity for growth, and shifts from a position where it helps and supports to one where it dominates and controls. Its power to control investment, allocate resources and facilities, and command knowledge, gives it a level of relative autonomy which enables it to expand beyond its previous regulative and facilitative functions (Pahl, 1977).

Saunders (1981) argues that the state now exhibits a dualism in its function and form. This is expressed in two conflicting sectors which Saunders identifies as the competitive democratic sector and the corporate sector. In the competitive democratic sector the state performs its traditional role as an institution of representative democracy. It acts as a forum for competitive interests and for the expression of popular pressures from which the state largely derives legitimisation of its policies. This sector is structurally associated with the local level of government, the local political agenda and popular political participation. The local government is structurally

accessible to people and is a point of daily contact between them and the state.

The state also serves the newly emergent corporate sector (Jessop, 1978). This sector is exclusive to the representation of the interests and functions of large capital and organized labour. The corporate sector is most typically found at the national level, although it may exist at all levels of the state. Social investment (the socialization of capital investment by the state to reduce costs to the private sector) is primarily the function of large national corporations. Most of the important economic and social policies are now determined in the corporate sector, and consequently, have been removed from the reach of local control.

Saunders (1981) identifies the local state, being the site of competitive as opposed to corporate interests, to be the locus of social consumption rather than social investment. Although operating within the context of overall political and economic constraint, local government assumes the responsibility for the provision of collective support of the labour force. The manifestation of the tension between corporate national interests and competitive local pressures, according to Saunders (1981), reflects the more fundamental tension between the State's role in supporting capital accumulation through social investment and social expense, and its need to accommodate popular demands through social consumption.

According to Navarro (1976B), the health sector has increasingly become a part of the state for 3 reasons: (1) most people living in capitalist societies perceive the provision of an adequate

health care system as a public concern; (2) medical training and research, and delivery of health services is increasingly financed from public funds; and (3) the ideology and organization of medical care, which reinforces the capitalism, is guaranteed through state intervention. As indicated above, health, education and social welfare services all form non-coercive social institutions through which the state can provide services and convey ideological messages that sustain and legitimate capitalism (Waitzkin, 1978).

The state is, however, capable of responding, in a pluralist manner, to health demands and pressures from the community. It mediates these pressures through subsidizing the demand for health care, socializing certain costs of the production of health care, and imposing working condition standards, environmental controls, and drug and food regulations (Renaud, 1975). Central government most actively pursues health policies and programmes that encourage change in individual behaviour and safety without threatening the basic structure of capitalism. The state publicizes the needs for wise eating habits, exercise, individual restraint in tobacco and alcohol consumption, encourages workers to be more careful, or provides incentives for better safety standards (Renaud, 1975). The state may enact health legislation, enforce regulations and encourage certain behaviour, but such action is compatible with profit accumulation.

State intervention is restricted to policies and programmes that do not conflict with the overall interests of capital and with the basic principle of profit accumulation (Waitzkin, 1978). The state will not act against (if it were practically possible) the social alienation and affluence created by economic development.

Therefore, it is unable to provide real solutions to many of the health problems that exist within capitalist societies. Renaud (1975) believes the use-value of a health service in meeting the health needs of a population is not at stake, but rather its value in gaining popular support and its value in reproducing conditions necessary for capitalist growth.

One of the major problems reflected in state involvement in health, today, is the fiscal crisis of the modern state in meeting the costs of social investment, consumption and expense. O'Connor (1973) has discussed the fiscal crisis of the state in detail. Essentially, the socialization of costs and the private accumulation of profits, has created a fiscal crisis since the requirement for state expenditure to facilitate private capital accumulation has grown more rapidly than the means to finance it through state revenues (O'Connor, 1973; Taylor and Hadfield, 1982; Eyles and Woods, 1983; Ambrose, 1986). The fiscal gap in meeting social consumption is reflected in social problems and urban conflict. The demand for public expenditure on health care has, for example, outstripped the ability of the state to fund that expenditure. People have become increasingly dissatisfied with the provision and quality of health services publicly available to them through state intervention or privately through their ability to pay for care.

The basic tenet of capitalism is that in the long run, the overall costs of the public sector will not be paid for at the expense of corporate profits (Krause, 1977). The growth of public social expenditure is seen by monetarists to be dysfunctional for capital since increased state expenditure becomes detrimental to private

economic growth (Ham, 1982; Cameron, 1982; Saunders, 1985). The state can no longer simultaneously satisfy consumer political demands for collective consumption and maintain conditions for private accumulation. As a consequence, the state tends to sacrifice social expenditure and attempts to seek alternative means of financing essential services (Taylor and Hadfield, 1982; Gough 1983).

In New Zealand, as in Britain, the state plays a dominant role not only in the provision but also in the regulation of health care. New Zealand's public sector grew rapidly after World War II. Direct state involvement in New Zealand's health sector was firmly established after the introduction of the Social Security Act in 1938. The First Labour Government proposed that a national health scheme, funded publicly through government taxation, would make health care freely and universally available to all New Zealanders (Lovell-Smith, 1966; AJHR, 1975; Fraser, 1984; Hay, 1985; Public Service Association, 1985A). This was never fully realized because of intransigent opposition mounted by the medical profession. Primary care is provided in the private sector by general practitioners who are remunerated on a state subsidized fee-for-service basis, and the state is the dominant funder and provider of hospital care. The public hospital sector captured substantive capital investment.

However, the fiscal crisis of the state, and more specifically, the escalation of costs in and performance of New Zealand's public health system in recent years, has prompted the Government to reassess its involvement in the health field. A response to the overall fiscal crisis of the state, more generally, has been the reprivatization of the public sector (as evident in the economic restructuring of New

Zealand's economy in the last five years). Reprivatization through fiscal pressures has implications for the provision of health care, especially hospital services (McKinlay, 1980; Elling, 1981; Barnett and Barnett, 1988).

New Zealand's government has, for example, expressed a desire for reform of the public health sector (e.g. Health Benefits Review Committee, 1986; Report of the Hospital and Related Services Task Force, 1988) with the intention of making health services more efficient as well as more effective. Reduction in state involvement has been viewed largely in terms of restructuring health services away from collectivism and public funding to increased reliance on the market and stress on self help whereby individuals, and not the state, are responsible for health (Weller and Manga, 1983; Barnett and Barnett, 1988). This is founded on the belief that many health problems arise from individual and not structural causes, and that individuals will act responsibly if they are forced to bear the costs of care directly.

New Zealand has seen a rapid growth in the private hospital sector especially in the care of the elderly and the provision of non-acute medical services, and in membership to private medical insurance schemes (Chetwynd et al, 1983; Public Service Association, 1985B; Barnett and Barnett, 1988; Joseph and Flynn, 1988). There have also been moves towards the de-institutionalization of care with increased emphasis on community based service provision (South Island Correspondents, 1980; Malcolm, 1983; Health Benefits Review, 1986). However, these responses to the fiscal crisis in the health care sector, are problematic in their spatial, social and

organizational expression. The concept of reprivatization of the public hospital sector has met with vociferous public opposition, and the state has been quick to distance itself from definitive action. Thus, despite calls for reform, New Zealand's public hospital sector has essentially remained intact and its resource base largely untouched, and the state continues to be the dominant provider and regulator of hospital care in New Zealand.

## **2.4 PARADOXES IN HEALTH CARE**

It is taken for granted that modern industrialized populations are healthier than their predecessors, and most people accept without question the assumption that improved standards of health are attributable to the developments in scientific medicine and to the vast quantity of resources invested in health services. McKinlay and McKinlay write "The modern 'heresy' that medical care (as it is traditionally conceived) is generally unrelated to improvements in the health of populations (as distinct from individuals) is still dismissed as unthinkable" (1977, p405).

Powles (1973) suggests that a most striking paradox in health care lies in the contrast between the enthusiasm associated with current developments in medical care and the reality of decreasing returns to health for the rapidly increasing efforts. Increases in national expenditures on health are well documented (Smith and Tatchell, 1979; Schieber, 1985). Most Western economies have over the last 20 years increased expenditure on health from around 3-5% of Gross Domestic Product (G.D.P.) in the early 1960's to about 5-

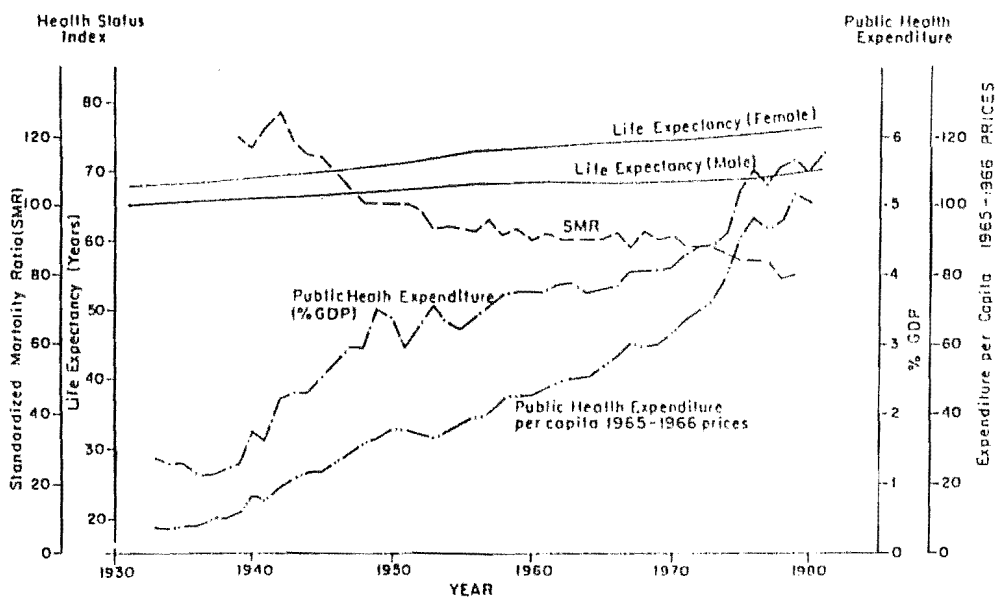


7.5% by the mid 1970's (Smith and Tatchell, 1979) with expenditure continuing to rise in the 1980s.

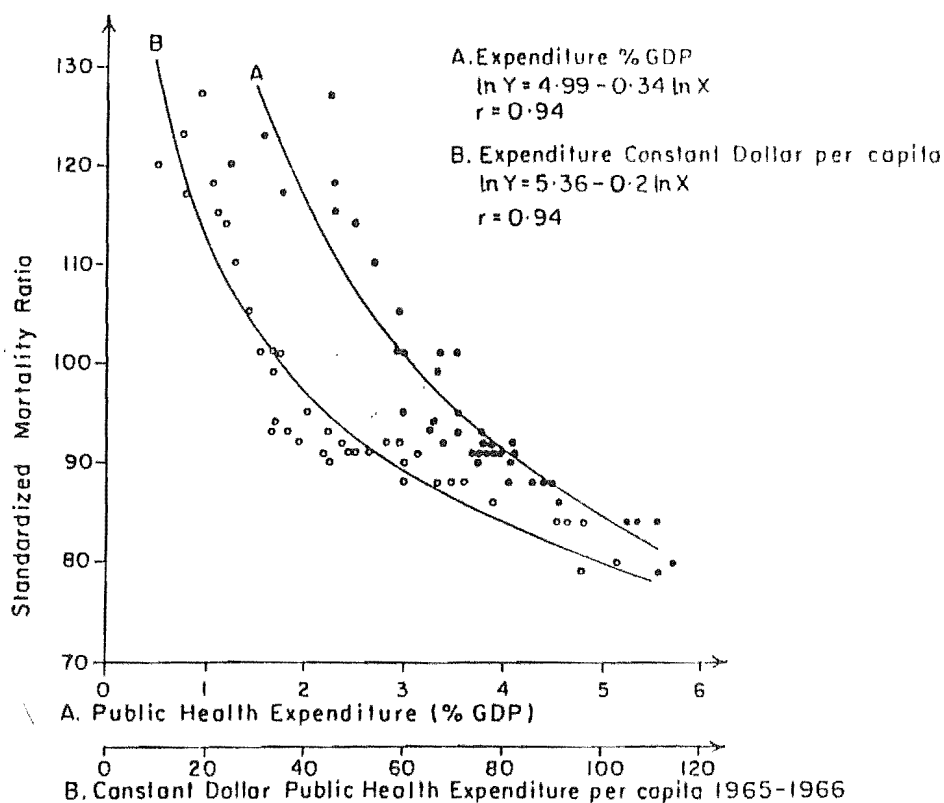
In New Zealand, public health expenditure as a proportion of G.D.P. rose steadily from just over 1% in 1935 to 5.5% in 1980. The 1987/88 budget estimates show that 15.1% of total government expenditure went to Vote Health - double the 1951 level (AJHR, 1987). In 1987, some \$3,410m (current dollar terms) from the public purse was allocated to health. This public expenditure contributes to approximately 80% of the total expenditure on health in New Zealand.

However, New Zealand's health system, like those of other developed countries, appears to be characterized by diminishing returns to improvements in gross indices of health status from its increased expenditure and investment in health care resources (Easton, 1976). Trends over the period 1931 to 1981 in life expectancy at birth for males and females, standardized mortality ratio (SMR, base year 1950-1952), and expenditure on New Zealand's public health system (per capita 1965-1966 constant dollars and proportion of G.D.P.) are shown in Figure 2.3. The relationship between SMR and both measures of public health expenditure illustrates diminishing returns in relative improvements in levels of mortality over this period (Figure 2.4).

McKinlay and McKinlay (1977) report a similar situation in the United States. Between 1900 and 1973 a 69.2% decrease occurred in the overall age- and sex-adjusted US mortality rate. Of the total fall over this period, 92.3% occurred prior to 1950. "It is



**Figure 2.3:** Health Status Indicators and Public Expenditure on Health.



**Figure 2.4:** Relationships Between Standardized Mortality Ratio and Public Health Expenditures.

evident that the beginning of the precipitate and still unrestrained rise in medical care expenditures began when nearly all (92 percent) of the modern decline in mortality this century had already occurred" (McKinlay and McKinlay, 1977, p414). Powles who investigated trends in three major mortality indices (infant mortality, life expectancy at birth and at age 45 years) in England and Wales for the period 1870 to 1970 also states "... it is precisely during the last two decades - when scientific medicine is alleged to have blossomed and when the quantity of resources allocated to medical care has been rapidly increased - that the decline in mortality that has been associated with industrialization has tapered off to virtual zero" (1973, p2).

The contribution of modern health care systems to decreases in mortality reflect two major factors: (1) the shift in disease burden and the inability of medicine to cope adequately with the 'diseases of modern civilization' and (2) a misinterpretation of the importance of the different determinant of health which reflects in society's chosen form of health intervention via the medical system.

#### **2.4.1 Shifts in the Burden of Disease**

Powles (1973) suggests that the problem of diminishing returns results from the nature of the contemporary disease burden and the limited front on which medical effort has been concentrated. A major part of the fall in mortality rates is directly attributable to the virtual disappearance of the major infectious diseases (McKinlay and McKinlay, 1977; McKeown 1979). Dramatic shifts in the patterns of disease and ill-health have occurred with the development of society.

During the early part of the 20th century the major health threat to populations came from infectious diseases; epidemics of tuberculosis, influenza, pneumonia, whooping cough, measles, scarlet fever, diphtheria, smallpox, cholera and typhoid. Deaths from these infections have fallen sharply and they now have a negligible impact on health status of Western populations.

Health problems in the 1980's for countries like New Zealand are principally those associated with ageing populations and with affluent lifestyles. Thus, the infectious disease burden on health has been replaced by diseases characteristic of modern society. Powles states, "Industrial populations owe their current health standards to a pattern of ecological relationships which serves to reduce their vulnerability to death from infection and to a lesser extent to the capabilities of clinical medicine. Unfortunately this new way of life, because it is so far removed from that to which man is adapted by evolution, has produced its own disease burden. These diseases of maladaptation are, in many cases, increasing" (1973, p12). Heart disease, cancer, cerebro-vascular disease, diabetes, asthma, arthritis, epilepsy, motor vehicle accidents, alcohol and drug abuse, tobacco smoking, obesity, and mental illness, dominate mortality and morbidity statistics in developed countries. None of these is a communicable disorder. All stem from the contemporary social and physical environment.

Is the abrupt increase in the 'diseases of civilization' real, or just a consequence of people living sufficiently long to succumb to degenerative processes? It was first argued that modern health problems were an inevitable part of the biological ageing process. As

life expectancy increased, more individuals survived into the older age-groups, and since the 'aged' were those at most risk biologically to chronic and degenerative health problems, these diseases naturally increased. The analyses of age-specific morbidity and mortality profiles, however, show that the prevalence of chronic illness has increased even in working-aged populations. Thus, degenerative processes associated with aspects of biological ageing can only partially account for the rapid emergence in the modern disease burden.

An important precipitant of current health problems is the substantial changes to lifestyle and the physical environment incurred in post-industrial society. Emphasis is given particularly to changing aspects of diet, exercise, and social stress. Burkitt (1973) and Powles (1973) both argue that the commonest diseases of modern economic development are almost absent in non-westernized communities that have deviated little from their traditional ways of life, especially those communities that have not adopted western dietary patterns.

Doyal (1979) points out that while all individuals have to some extent become maladapted to their material environment, illness, disability and premature death, is not evenly distributed throughout society. Doyal believes Powles' concept of biological maladaptation should be extended to incorporate other aspects of social and economic organizations which structure present patterns of health and illness. People are genetically unsuited to modern lifestyles and this appears to have created a new spectrum of disease.

The new disease burden comprises health problems which orthodox medicine is least able to prevent, or adequately treat. A gap has emerged between the occurrence of health problems and the services which are supposed to take care of them. The medical model, based on the system of engineering intervention, has maintained an emphasis on curative rather than preventive services and through biomedical advances has concentrated intervention even more on acute conditions and technological solutions, and has increased medical specialization. Health care has become depersonalized and removed from the experiences of many individuals. Resource allocation to the health sector may in reality be derived more from the beliefs and traditions surrounding medicine than from evidence of its utility in prolonging or in improving the quality of life.

#### **2.4.2 Milieu as a Determinant of Health**

As identified in Section 2.2.1, health is the outcome of the complex interaction occurring between people, their physical and social environment and the availability of health care resources. McKeown (1979, pXV) states that "Medical science and services are misdirected and society's investment in health is not well used, because they rest on an erroneous assumption about the basis of human health. It is assumed that the body can be regarded as a machine whose protection from disease and its effects depends primarily on internal intervention". Paradoxes in health care have arisen partly because while countries concentrate health improvement efforts on medical intervention via the health care

organization, environmental and lifestyle factors have not really been tackled.

The introduction of specific medical measures and/or the expansion of medical services are generally not responsible for most of the modern decline in mortality (McKinlay and McKinlay, 1977). The contribution of 'effective' medical measures did not become a factor in infectious disease control until the second quarter of the century. The introduction of antibiotics and immunization programmes were heralded as the dramatic breakthrough in the fight against infectious diseases. However, the larger part of the total decline in death rates had already been achieved prior to their introduction, and prior to the formation of formal national health care systems. McKeown (1979) reported from his historical analyses of the major reasons contributing to the decline of mortality in England and Wales over the last 100 years that the main influences on the decline in mortality were improved nutrition on airborne infections, reduced exposure (from better hygiene) to water and food-borne diseases and less from immunization and medical treatment of a large number of miscellaneous disorders.

Recognition of the significance of the physical environment and factors associated with the way of life in the causation of ill-health and premature death, helps to explain why the provision of medical services has been found to be only indifferently related to health outcomes. Historical and cross-sectional studies (Glazer, 1971; Joyce 1972, Williams 1975, Bradley et al, 1976; Martini et al, 1977; McKeown, 1979; Newhouse and Friedlander, 1980) indicate that the relationship between measures of health and the supply of

medical resources is often confused by the impact of socio-economic and environmental factors. The effect of medical resources on health outcomes may become statistically significant when analyses control for these factors (Wolfe, 1986).

Williams (1975), for example, investigated neonatal mortality as a function of the intensity of hospital based medical intervention and of birthweight which is strongly related to the socio-economic and physical environments of the expectant mothers. His results indicated that a 10% increase in the supply of obstetricians and gynaecologists to the number of hospital born infants produced a 0.75% decrease in the observed neonatal mortality rate. The impact of a shift in birthweight distribution, reflecting improved environmental conditions, was, however, an order of magnitude greater than the effect of medical resources.

There are a number of methodological problems involved in defining and measuring levels of health status, and their relationship to the availability of medical resources (Bice, 1976; Martini et al, 1977; Bice, 1979; Hyslop et al, 1983). The discussion above has largely focussed on mortality as the final end-point of health, but this is not necessarily the best indicator of health or the most sensitive indicator of the effect of medical care on individual or community health. While mortality is a crude indicator of health status, and morbidity data is no doubt a better measure, morbidity has traditionally been measured in terms of hospital use, which, as this thesis argues may be induced by the medical system itself. Thus, hospital discharge is not necessarily representative of health needs.



It would be quite incorrect to suggest modern health services have had no effect on improving health standards. For example, immunization and medical intervention were key factors in the disappearance of some infectious diseases such as diphtheria, pneumonia, or poliomyelitis. It should be remembered that most of the decline in mortality occurred before modern health care systems were developed, and thus their contribution in the longer time is relatively small compared to changes in the physical environment and improvements in standards of living. Wolfe (1986) also states that health care expenditures do bear a positive relationship to health if one holds constant those changes in lifestyle that impact on health (e.g. smoking, drinking, traffic accidents, occupational hazards), and inflation and population size are adjusted for.

Furthermore, in modern society, medicine plays an important functioning in improving the quality of life which is not necessarily reflected in reduced rates of mortality. Major medical advances in treatment of disorders like heart disease, respiratory problems, cancer, have not advanced life expectancy but they have added to the quality of life of people suffering from these problems. In general, however, what individuals do for themselves is probably more important to their health than the quantity of medical resources available to them (Martini et al, 1977; Newhouse and Friedlander, 1980).

### **2.4.3 Iatrogenesis**

One further comment is required on the outcome of scientific medicine in society. This involves Illich's idea that modern medical

care is actually damaging to health (Illich, 1977). Illich believes industrialization is the main process shaping society, and therefore the driving force behind the structure of health care. The industrialization of medicine entailed both the professionalization and bureaucratization of medicine. The medical profession are the technocrats and elite of the health field. Illich (1977) argues that the antagonistic conflict between the medical establishment and the consumers or clients (the patients) of the medical bureaucracy appears as iatrogenesis - damage caused by the process of medical intervention. He identifies three types of iatrogenesis: clinical, social, and structural (cultural).

Clinical iatrogenesis, the most immediately evident and well documented, comprises all clinical conditions for which components or operations of health services caused physical or mental harm (injuries, pain, or death). Such damage is caused largely through the misunderstanding and misinterpretation of health problems, from therapeutic intervention, and from sheer medical incompetence. Illich (1977) also sees the abuse of confidence and moral conduct as clinically iatrogenic. For example, he argues negligence is rationalized in large complex hospital settings as random human error, or system breakdown. Scientific detachment leads to depersonalization of diagnosis and treatment. As a consequence, malpractice is reduced from an ethical issue to a mere technological problem, which flouts the moral and ethical trust society instills in the profession.

Social iatrogenesis, in contrast, involves the additive dependency of modern society on medical care (Illich, 1977; Crane

and Legeay 1979). The over-medicalization of life, the belief individuals cannot cope with illness without modern medicine, and the addiction of people to medical care as a solution to all their problems in life, is regarded by Illich as irreparably damaging to health (Doyal, 1979). The basic cause of social iatrogenesis is the manipulative behaviour of the health services system to perpetuate and encourage use of its resources (Zola, 1975; Navarro, 1976B; Crane and Legeay, 1979). As stated previously, the medical establishment derives its power from its virtual monopoly over the definition of health, the social legitimization of illness behaviour, and the deployment of medical resources and methods of intervention. Illich (1977) argues the health services system creates ill-health by increasing stress, decreasing levels of tolerance to pain, generating new needs, and disabling independence.

The third form of iatrogenesis involves the destruction of people's self autonomy. Illich (1977) believes modern medicine has had a health denying effect by destroying the ability of individuals to deal with their own human weaknesses, vulnerabilities, and experiences. According to Illich "health has ceased to be a native endowment each human being is presumed to possess until proven ill, and has become an ever-receding goal to which one is entitled by virtue of social justice" (Illich, 1977 p122). The solution to this social conflict lies in the de-bureaucratization and de-professionalization of medicine. Health care, according to Illich, has to be re-appropriated by the people and individuals must assume responsibility for their own health.

## 2.5 SUMMARY AND CONCLUSIONS

Individual health represents a balance between the functional utility of people to perform those tasks required of them by society and their experiential well-being derived from their social circumstances. The definition of health has become increasingly politicized as the conceptualization of health is inextricably linked to events in society. The modern medical model is based on a mechanistic conceptualization of the human body. Its ideological basis and functions reflect not only the scientific and technological advances that take place in the wider society but also social and political developments.

Medicine is assumed to be a science, and therefore assumes the neutrality and objectivity afforded to scientific pursuits. It promotes a doctrine of specific aetiology of disease and contains reductionist assumptions that makes ill-health a problem of individual human beings. The responsibility for health and cure of ill-health is seen to rest with individual people rather than collectively.

Although ill-health was originally conceived as having little relationship to social or economic conditions, attention over the last twenty years has focussed on lifestyle as a prime determinant of health. However, the level and form of medical intervention related to lifestyle politics can be contained within the overall relations of capitalism, and thus the potential threat to the requirements of capitalism minimized. Modern medicine is based on a scientific and technological approach to health where emphasis is on cure rather than prevention. As a result, the organization of health care involves

both the specialization of medical skills and concentration of health care resources.

Medicine is perceived to be beneficial to society in improving the health status of individuals, and populations, but there are paradoxes in health care. There is an enthusiasm and demand for health care in society, but in reality, there is an increasing volume of evidence that suggests that there are decreasing returns to health for society's investment of resources. The profile of disease burden has changed over this century from infectious diseases to 'diseases of civilization'. The causation of both appear to stem from conditions of the physical environment and lifestyle factors. However, the medical model has largely misunderstood, or chosen to overlook, these determinants of ill-health. Medicine is misdirected in its attempts to solve health problems because it fights disease and illness on a very limited front defined by its own evolution and ideology. Illich (1977) argues that modern medicine is actually damaging to health.

Marxists believe the provision of health services reflects both the social demands made by labour and the social needs of capital. The main role of medicine is to legitimize the capitalist system and promote capital accumulation. The health sector helps to reproduce labour as an input in the production process and by acting as an agency of social control, helps to reinforce the relations of production. Navarro (1978) believes health care systems do not necessarily exist to solve or cure ill-health, but rather, to take care of and administer the problems created by the capitalist system.

State intervention is a major factor influencing health care organization and health outcomes. This is now true for all political systems. Although the State's main function under capitalism may be to protect the capitalist economic system, it is responsive to certain popular demands and social pressures for health care. In New Zealand, the state is responsible for ensuring an adequate provision of health care to all individuals.

Marxist analysis yields broad structural explanations of social systems like health care, but this mode of theorizing is problematic in a number of respects. First, Marxism has been criticized for its inability to deal with real situations, especially at the local level. Actual social, political and economic relations force a retreat to the level of abstraction which becomes difficult to relate to empirical instances (Leonard, 1982).

Second, if structuralism is to avoid just being a crude application of Marxist theory and is to become an adequate explanation, then a fuller specification of how the central economic, political and ideological relations are articulated through out society, and how they express themselves in the functioning of different organizations and institutions, is necessary (Williams, 1982). Structuralists argue, for example, that the allocative processes in health care and the patterns of outcomes generated, are essentially derivatives of class conflict and the supporting role of the state in maintaining capitalist production. Most writers remain unclear as to how these are determined by class struggles and by the state.

The other major problem is associated with practices in structuralist analysis. Williams (1982) states that outcomes cannot simply be read off from structural inputs, processes operating in organizations may act to transform them. The actions of administrative or allocative agencies cannot simply be deduced from the assumed interests of the dominant class. The behaviour of organizations can only really be uncovered through an examination of their practices.

The understanding of the organizational form that health care systems assume and the distribution of conflicts and benefits that ensue, particularly at the local level, requires the identification of the actors within the health sector and an understanding of the power distribution and dynamics that exist between them. The medical profession remains central to issues of health care not only as a vehicle through which the ruling class can exert power to maintain and legitimate capitalism but also as a force in its own right. Eyles and Woods (1983) state that Navarro does little justice to the activists and reformists in the medical profession with his simple assertions that health care policy and legislation stem from the demands of labour and the legitimizing needs of capital. Physicians play an active role in shaping medical practice by instigating changes and reforms, and these may have systemic repercussions.

The mode of explanation needed to unravel the factors and processes involved in health care, must incorporate multicausal explanations of everyday realities. The degree of influence of structural forces and the complexity of interaction varies at the different levels of analysis. A higher degree of abstraction appears to

yield a most satisfactory explanation at the national level. Health care policy and action at the regional and local levels, although couched in the overall economic imperatives of society, will tend to reflect pluralist activities of different interest groups. Health care systems are dialectically determined by forces within and outside of the health sector. This chapter has examined societal forces and it is to the forces and actors within the health sector that attention now turns.



## CHAPTER THREE

# MANAGERIALISM IN HEALTH CARE

### 3.1 INTRODUCTION

Health care constitutes a unique political situation - a situation that has pervasive and significant social ramifications. As discussed in the previous chapter, the political economy approach to health care explains phenomena in terms of the fundamental conflicts existing within society. This approach naturally draws attention to the deeper meaning and intent of health concepts, medicine's role in society and the interests being served (Ham, 1982). The political economy approach stresses the structural relations governing health care, that is, the forces that shape and define the set of rules, values and parameters of the containing society in which health care is located.

It is equally important, however, to examine factors internal to the health care system itself. The nature of health care systems reflects the organization of and the managerial control over resources, and the conflicts generated between visible actors within the health system. Freidson (1970) and Alford (1975) both argue that the continuing dominance and control of the medical profession over the provision of medical services is the most singularly important structuring element of health care systems. The medical profession is a key political variable in the determination of health care.

The administrative structures for the allocation of resources are important factors giving rise to the social environment. Irrespective of the theoretical approach adopted, the explanation of the realities of health care, must lie, at least in part, with the analysis of the actors involved in the system and the ways in which power is exercised. It is important to understand the formal processes of resource allocation and how organizations and inter-organizational networks act as instruments or agents of control.

Having examined the political economy of health care in Chapter Two, the aim of this chapter is to explore more fully the importance of organizational and political factors within the health care system as explanations of local health care contingencies. The Chapter examines managerialism as a mode of analysis and looks at its application to health care. Managerialism has major relevance to the health sector, because it is a mode of explanation that stresses the effect of institutional arrangements and controls on spatial processes and individual actions. It is argued that the medical profession are the gatekeepers to health care and the day-to-day managers of the system. This Chapter, therefore, examines the role of the medical profession and the relationships between the key actors in the health sector.

### **3.2 URBAN MANAGERIALISM**

Managerialism has not been directly applied to the health field. Applications of the managerialist approach in geography have largely been with reference to housing, a situation which has, however, a

number of parallels to health care. Basically, Pahl (1970; 1975), the main proponent of managerialism, believed that social and spatial structures should be examined in terms of the constraints placed upon, and the conflicts existing between different individuals and groups in competition for desirable yet scarce resources.

Pahl (1970) claimed that there were both fundamental spatial and fundamental social constraints on access to scarce urban resources and facilities, such as housing or health care. These constraints which condition people's life chances, are generated by the processes of allocation. Socio-spatial conflicts and inequalities in distributional outcomes would reflect the distribution of power underlying allocative mechanisms. Pahl argued that if resource distribution and patterns of access to urban facilities were to be understood then the role and behaviour of the *urban managers and gatekeepers* had also to be understood. It was they who, by occupying key positions in public and private sectors, controlled the allocation of resources and the workings of the urban system. In attempts to understand patterns of housing allocation in Britain, for example, geographic explanation was sought in the system of bureaucratic rationing that was operating in the British public housing sector (Gray, 1976; Taylor, 1979; Taylor and Hadfield, 1982; Clapham and Kintrea, 1984). Attention focused on both formal and informal procedures by which local housing authority officials and agencies allocated their available housing stock. Although British governments have generally encouraged wide-ranging access to council housing, demand has effectively been controlled by the policies of individual local authorities (Clapham and Kintrea, 1984). The discretionary nature of housing rationing has major implications

in both the selection of households to be housed and in the assignment of particular dwellings. Allocative systems in which decisions are made not on the grounds of set criteria but rather 'on merit', obviously contain dangers of favouritism and corruption, even when decisions are based on a loose code of practice (Clapham and Kintrea, 1984).

Rex and Moore (1967) and Pahl (1977) suggest that structured and systematic inequalities can be generated independently of an individual's position in the labour market (defined by their ownership of capital or market value of their labour). People in the same labour market position could experience different degrees of access to available resources. Rex and Moore (1967) believed, for example, that the operation of the housing market led to the emergence of 'housing classes' which were distinguished from each other by their varying degrees of access to housing and their strength in the market. This reflected their political influence or status in the system of housing allocation (Rex, 1968).

While Rex and Moore's interpretation of housing classes has come under criticism, it did serve to show that bureaucratic rules and procedures operating in, at least housing, can have systematic and discriminatory effects. These effects then give rise to shared views of deprivation, or privilege. There is little reason not to believe that similar processes are operating in other areas of social consumption.

Pahl's original managerialist thesis argued that the urban managers exerted an independent influence on the allocation of

scarce urban resources and facilities (Pahl, 1970). The managers and gatekeepers collectively through the operation of their bureaucratic rules and procedures were believed to determine, for example, the distribution of housing opportunities in Britain, and therefore, the level of local consumption of housing resources. The actions of the managers could reinforce, reflect or reduce the inequalities engendered by the differentially rewarded occupational structure (Pahl, 1977).

The two main constructs of Weberian political sociology are: (1) there is no necessary relationship between economic classes and politics; and (2) that the mode of political domination in modern society is increasing and the administration of society is of necessity becoming more rational and bureaucratic (Leonard, 1982). Although not explicitly stated, these Weberian principles underly the managerialist thesis (Harloe, 1977).

Weber made a clear distinction between economic and political aspects of society (Leonard, 1982; Harloe, 1977). Class struggles were seen as an economic reality which related to the opportunities for gaining income and levels of consumption. Economic issues constituted only one of the bases of urban conflict and social change.

Weber also argued that one of the main prerequisites of the modern State was the development of a rational and bureaucratic apparatus for administration (Leonard, 1982). This effectively reduced the likelihood of political control over the State. Power and bureaucratic organization were unproblematically linked in the mode

of domination, which was seen to be independent and neutral with respect to class interests (Harloe, 1977).

Both Weberian concepts of the autonomy between the economic and political dimensions of society, and the process of increasing bureaucratic development and control, were central to Pahl's original thesis. Managerialism was, however, severely criticized for analysing patterns of the urban system from a perspective which failed to take into consideration the links between the so-called urban managers and the broader political economy (Pahl, 1975; Gray, 1975; Harloe, 1977; Williams, 1982).

Two main weaknesses were identified in managerialism. The first major criticism related to the assigning of independence and autonomy to the managers. Autonomy in decision-making could simply not be sustained in many cases. It is now argued that the actions of the managers occur within, and are constrained by, the economic, political and social relations of society. Also the fundamental notion of scarcity of resources was taken for granted, yet scarcity in itself depends on particular relationships within society. Managers allocate scarce resources, but they do not create the situation of scarcity themselves. An institutional approach to provide adequate explanation needed to incorporate analyses of broader societal structures in which the managers operated. This would include the analysis of how others exerted influence over the allocative processes used by the managers to distribute resources.

The second weakness was that there was no unbiased basis for the selection of who constituted the managers and gatekeepers, nor

any clear means for analysing their relative power (Saunders, 1981; Williams, 1982). The actual goals and ideologies of those who manipulated the housing market were never really questioned for example. The managers were assumed to be those who occupied, within agencies, positions with executive power. As Williams (1982) identifies, the nature of that power and the limits of discretion were not fully explored. The focus was on empirical outcomes, that is on data of actual allocations from which spatial processes were then inferred.

Pahl (1975) in light of these criticisms, reformulated his earlier ideas, maintaining that the study of urban managers and gatekeepers provided a useful research strategy. The value of the managerialist approach is in explaining issues located at the interface between the allocators and the consumers. The revised version of managerialism became more concerned with power relations, the goals and ideologies of organizations, and with the constraints they face in implementing policy (Williams, 1978). The role of managers is one of mediation and allocation. Managers still have discretion within sets of guidelines and procedures. In housing or health, statutory obligations may be placed on local authorities by central government, but their interpretation and implementation is the prerogative of local officials.

Saunders (1981) situates Pahl's managerialist thesis in a broader theoretical context of the State which explains why local State officials become mediators between the pressures of central government, the private sector and the population. "Urban managers straddle the division between the corporate and competitive sectors,

the central and local levels, and economic and social policies" (Saunders, 1981; p44). If the managers mediate between central State and local populations, and between the private and welfare sectors, then their role remains crucial to the understanding of the urban environment.

The status of the urban managers in this mode of analysis has changed from the overriding independent variable to an intervening factor which is still worthy of study. Pahl argues socially designated surplus product is geographically concentrated through the process of urbanization. "Urban managers remain allocators of this surplus; they must remain central to the urban problematic" (Pahl, 1975, p285). "So long as the surplus has to be concentrated in order to be redistributed, so long rules have to be generated and agents have to apply them. Some may think that the managerialist thesis is dead: whether or not that is so, I am quite certain that the managers will not lie down" (Pahl, 1979A, p89).

### **3.2.1 Organizations, Social Relations and Managerialism**

As will be seen in subsequent chapters, individuals gain health care from a variety of services operating within their local health care system. Urban managerialism was initially criticized for the selection basis of who constituted urban gatekeepers, and for assigning them independence and autonomy in their actions. Although reformulations gave greater consideration to the constraints under which the allocators of resources operated in implementing policy, analysts of power structures now realize that inter-organizational networks rather than individual institutions form the main apparatus



through which power is exerted and through which consumers must access goods and services. Consumer populations are served, processed, harassed not by single organizations but by a number of related organizations (Hall et al, 1977). Thus, for managerialism to provide an adequate explanation of social conflict and distributional outcomes, the actions of 'managers' of individual agencies need to be considered within the organizational network in which their institutions operate.

The operational objective of organizations as individual structural entities is to pursue and defend an adequate supply of resources - clients, money and/or authority. It is assumed that decision-makers are oriented towards this objective, and the more abstract goals of the organization recede into the background, to be used ostensibly when ideological legitimation of on-going activities is required (Benson, 1975). The way in which organizations operate will be guided by their ostensible objectives, but the apparatus of organizations tend to develop independently of the original objectives used to legitimate the organization's existence. Organizations develop an interest in self-perpetuation and expansion beyond the roles that were intended (Marion and Flowerdew, 1982).

A network of organizations consists of two or more distinct organizations that are linked directly or indirectly with each other. General practitioners, medical specialists, health clinics, and hospitals all operate, for example, as separate managerial health services but are organizationally linked in the health care system. Inter-organizational networks or systems develop when individual organizations perceive mutual benefits or gains will accrue from

interaction, that is when each organization believes by interacting with other institutions, it will be better able to achieve its operational goal of acquiring resources. In some situations the motivation to interact may be asymmetrical so that networks form only when the motivated organization is sufficiently powerful to coerce or force the other parties to co-operate (Schmidt and Koran, 1977). Voluntary interaction tends to be characterized by co-ordination and co-operation between participants, whereas conflict and bargaining are more typical of asymmetrical relationships.

Resources are acquired by an inter-organizational network from its political economic environment. The flow of resources into the system depends upon the aggregate quantity of resources at the disposal of the network environment and the network's power to affect the level of allocation. An organization will exchange resources with the macrostructure and with other network organizations to maximize its own holdings. Authority legitimates the activities undertaken by the organization, giving it the right and responsibility to carry out its various programmes and actions within broad or specific problem fields. Activities to which the organization can stake legitimate claim to, define the organization's domain - its sphere of legitimate operation (Benson, 1975). The level of authority commanded by an organization is assumed to imply a certain claim to the supply of clients or financial resources. The supply of resources accords with the organization's performance in its prescribed domain - a health service that has competent physicians and health workers, and provides a good service to patients, attracts and maintains clients.

Emphasis in the exchange approach to interaction is on voluntary inter-organizational relations, but as Hall and his colleagues (1977) state, interaction can also occur via a mandate. In this situation interaction tends to be imbalanced in favour of certain organizations within the network and co-operation from the other organizations is not necessarily forthcoming. Laws and regulations are required to specify areas of domain, information and client flows, and financial obligations. They further suggest that domain subdivision may take place so that the network becomes a system of sequential interdependence between participating organizations. Each functions as a specialist unit performing its part of the larger network task. An unequal distribution of power to organizations of a network will arise from both the internal structure of the network and from external linkages to particular network organizations (Benson, 1975). Some organizations may provide services vital to the operation of all or most of the network organizations. Thus, these organizations gain power through their control over central functions around which the network is linked. As will be discussed in the next chapter, general practitioners hold a powerful position in the health care system because they control the referral of patients from the primary care sector to other services.

If an organization is an associate to the interests or ideologies of groups in the wider society, then it can mobilize forces external to the network in order to influence the flow of resources within the network and to ensure its own position. The structural environment in which inter-organizational relations are negotiated significantly affects the alignment and intensity of economic and political forces exerted on and within the network. The concentration or dispersion

of resources by the network's political and economic macrostructure presents an effective mechanism of control over the activities of the network (Benson, 1975). An inter-organizational network may however achieve a high degree of autonomy from environmental pressures and constraints.

A central concern of organizational analysis is the way in which complex organizations, such as the housing or medical systems, exercise control in society. This necessarily involves the examination of the role of organizations as a means of controlling different social groups, especially through the ideologies and interests of the gatekeepers and the technological imperative (Williams, 1982). Marxist theorists see organizational arrangements as reflections of the economic, political and ideological relations in society. However, the argument for structural control over members of organizations is problematic because of the partial commitment or allegiance of system managers to organizational activities or interests in the wider environment (Thompson, 1980).

Alternatively, bureaucratization may be the subjection of society to the influence of the values, attitudes, techniques and behaviour of bureaucrats (Thompson, 1980). Managers of local agencies can develop different beliefs and styles of operation depending on how strongly they identify with the interests of the central dominating authority, and the extent to which they have local autonomy and can support local interests against those of the centre (Pahl, 1977). The policies and actions of the urban managers will be influenced by the cultural values to which they subscribe and by the values and norms

inculcated by virtue of their membership to professional bodies and work environment and experiences (Marion and Flowerdew, 1982).

### **3.3 THE POLITICS OF HEALTH CARE**

#### **3.3.1 Managerialism in Health Care**

Having examined some of the main arguments of the managerial approach, this section now turns specifically to the health sector. What role does managerialism play as a mode of explanation in health care?

Medical geographers have not applied Pahl's urban managerialism to health care, yet health is a very important, and highly structured, area of social consumption. It is also subject to one of the most powerful professional interest groups in society. The importance of the medical profession in health care is, perhaps, taken for granted. While attention in medical geography concentrated on health care issues dominated by locational analysis and behaviouralism, conceptual and empirical links between Pahl's urban managers and members of the medical profession as the gatekeepers to health care were not established.

This thesis argues that people's experiences in obtaining health care reflect the bureaucratic or organizational elements of the health care system. Freidson (1970) more specifically, believes that individual health opportunities are really controlled by the nature of professional dominance in dictating and ordering the nature of work and activities within the health system. As stated above,

managerialism derives its greatest value at the interface between the providers and the users of services. Managerialism is concerned with the distribution and exercise of power at the local level, and specifically with the institutional arrangements and mechanisms through which resources are allocated. It therefore seems apt as a mode of analysis for examining issues concerning individual access to and use of health care resources.

In Chapter Two, the nature of the health system was discussed in reference to the political economy of health care. Keeping these broader factors in mind, the next two sub-sections elaborate on forces operating within the health care system. The aim of this discussion is to identify the existence of managerial control over resource allocation through the consideration of the dominance of the medical profession and their political interaction with other actors in the system.

### **3.3.2 Professional Dominance and Medical Elitism in the Health Care System**

Doctors are regarded as the managers of and gatekeepers to care. As a professional group, they are characterized by a high degree of autonomy. Professional autonomy involves a legitimate freedom to define the nature of its work, to control the quality of work produced, to establish entry qualifications and subsequent training, to operate disciplinary procedures within the profession, and to exclude non-recognized claimants from competing in the same field (Illsley, 1980). Commitment of individuals to a given profession involves their adherence to three sets of professional values: (1) a

personal commitment to the values and ideals that are held by the profession with regard to knowledge, skills and service to the community; (2) the commitment to apply such ideals via a professional occupation and career structure that defines and organizes work activities; and (3) a belief that the work, and the performer of that work, possess extraordinary characteristics - the work requires extensive training, intelligence, skill, and complex judgement (Freidson, 1970). The commitment of an individual to the medical profession therefore involves their belief in the ideals and values of medicine as well as their commitment to a particular way of organizing work within the health sector.

Doctors have established a professional monopoly in the provision of medical care. They maintain this position of power and dominance through a variety of professional devices. The basis of their power is the claim to professional autonomy. This gives control over medical knowledge, the contents and conditions of work, recruitment, training and the division of labour in the health sector, and the regulation and policing of the profession's activities.

Society condoned the medical profession's rise to power by accepting the promise that scientific medicine would deliver health. This essentially removed health issues from the day to day experiences and capabilities of the population. Medical practitioners gained ascendance because of their training in the use of scientific methods which enhanced their power in the diagnosis of ill-health. Where this could not be sustained on a scientific basis, they reverted to the 'priestly' role of adviser, and therefore, were still able to legitimize the adoption of the sick role by their patients. The medical

profession, thus, holds a monopoly over the definition of illness and health, and over the delineation of pathology and disease causation.

Prevailing concepts of health, and ill-health, also serve the interests of the medical profession as they legitimate the profession's claim to the control of the health care system (Ham, 1982). The widening of medical jurisdiction over problems formerly not conceived to be medical represents both the exercise and expansion of medical imperialism. Attaching medical labels to problems has major implications for the allocation of societal resources since the medical profession has sufficient emotive and political power to demand extensive support of their activities, even when there is no evidence that their institutions have any efficacious methods of dealing with such problems (Freidson, 1970).

While Illich regarded it in an iatrogenic manner, medical imperialism reinforces and reproduces the monopolistic powers of the medical profession. The control of knowledge and domain gives the profession the ability to achieve acceptance of its own conceptualization of health. As Ham (1982) states the medical concept of health makes sense to many groups in the population other than doctors, but it is not the only view of health nor necessarily the best to serve the interests of the population.

The medical profession is held in high esteem by the public in most countries. There is widespread societal consensus on the importance of the physician's role in mediating between the individual and processes of ill-health. The traditional and charismatic authority invested in physicians by the virtue of history



and scientific discoveries, has been rationalized through the powers of the law. The monopolistic position of the medical profession in providing health care has thus been guaranteed and sanctioned by the legal system.

Medical licensing legitimates the power to practice medicine for all individuals obtaining registration from the statutory medical body. As well as legally recognizing those individuals admitted into the profession, licensing laws prohibit all others from undertaking activities deemed to come under the jurisdiction of the medical profession. By law in New Zealand, and in other Western countries, the medical profession and the medical profession alone, has the legal control over the practice of medicine, the performance of surgery, the prescription of drugs or laboratory procedures. As Freidson (1970) points out, the capture of this exclusive control over the access to given sets of resources 'needed' to manage health problems makes the medical practitioner a forceful gatekeeper to items that are popularly valued. The doctor gains additional power from this role, since taking his advice is a prerequisite for obtaining the goods and/or services that are wanted independently of those offered by the doctor.

The economic and political autonomy of the medical profession varies between different social systems. Under capitalism, the profession does remain relatively independent to develop its own specialized area of knowledge and to determine scientifically acceptable practices. Freidson states "while the profession may not everywhere be free to control the *terms* of work, it is free to control the *contents* of its work. Similarly, it is free to control the

technical instruction of its recruits" (1970, p84). Freidson believes a profession is more likely to be self-directing in its work when legal or political privileges protect it from encroachment or competition from other sources.

The medical profession has also gained considerable prestige from its public image. The general public associate a career in medicine with extensive schooling, a long training period, acquisition of special skills and knowledge, and a commitment to a strict code of ethics. The elitism of doctors in the health sector relates strongly to their technical expertise and competence in protecting and often restoring health. Doyal (1979) argues that the technical expertise acquired by doctors through medical education and the image projected in teaching hospitals are important factors in ensuring the perpetuation of the health care system and the continuation of professional dominance. Krause (1977) believes that as long as medical expertise remains unevaluated by the population, it will remain a weapon in the hands of the medical profession.

Their reliance on the legal authority of institutionalized expertise allows medical practitioners to avoid using persuasive tactics to influence behaviour. The following of medical advice is projected as a matter of free choice, the burden of compliance is placed on the patient. The profession is thus protected since it is able to disclaim responsibility for coercing individuals into following their advice. However, Freidson argues that faith and trust are often placed on medical practices on the basis of imputed rather than demonstrated technical competence. The exercise of medical power would appear to rest more on the authority granted by

professional status than on the evidential merits of the profession. When seeking medical care individuals have little choice but to go to registered practitioners, and because of limited information are unable to make effective evaluation of their expertise. People are forced to rely on the authority of incumbency to which competence is imputed, as is the case for most bureaucratic offices where the incumbent is assumed to be competent through the status of holding that office.

Doctors also derive power and prestige as the recognized head of the medical hierarchy. As Krause (1977) identifies, the division of labour in the health sector is a broad based occupational hierarchy, but it is completely lacking in upward mobility. The combined effects of real technical expertise, legal requirements such as licensure or regulations in administration of services, and overall class structure in society hinder vertical movement between the different occupations. Its dominant position in the division of labour enables the medical profession to claim and maintain its jurisdiction and control over work activities, as well as shielding itself from outside influences.

According to Freidson (1970), professional dominance exerts a biased influence on planning and financing of health services. As a result the distribution of support and resources moves disproportionately through the health division of labour. As a consequence, the health services which gain support, may not be adequate or appropriate to the needs of the population.

The medical profession has also gained dominance through its claim to self-regulation and marked insulation from external observation. As a professional organization, it has gained maximum freedom to regulate itself through internalizing professional values, standards and codes of conduct. The effectiveness of methods of professional regulation and disciplinary action chosen by the governing medical body is not always evident to the general population, or even to some of its members (see correspondence and articles in the New Zealand or the British Medical Journals for example).

Assurance of standards of individual performance are largely a function of the organizational form in which medicine is practised: (1) in solo practice the burden of control rests on individual motivation and capabilities; (2) in group practice and colleague networks, performance can be gauged through the opportunities available for doctors to observe each other work. More importantly, economic and technical interdependence provides a collegial force to influence political and social behaviour; and (3) in large medical institutions the form of organizational hierarchy may set the professional practice of medicine apart from the administrative hierarchy. The practising medical specialist technically becomes subordinate in the bureaucratic system, and is open to the observation and influence by colleagues but is also structurally vulnerable to control by the administrative branch of the medical hierarchy (Freidson, 1970).

Even though some specialists are subject to peer review and disciplinary action, in New Zealand as in Britain, they largely remain

protected from general observation and accountability. In contrast, in the USA, members of the medical profession are subject to a variety of continuing evaluation procedures at the State level, such as recertification. More importantly, they are subject to malpractice suits by the public and are therefore accountable in open court rooms for their actions.

Overall, the medical profession has successfully extended its influence in the politics of health care, ensuring its interests are well protected and maintained. Through their professional organizations, the medical profession holds a monopolistic dominance over medical knowledge and skills, over the division of labour in health, and over the regulatory and governing processes which are supposed to safeguard the interests of the public. A network of social, political, legal and economic forces has evolved, and serves, to legitimate medicine as the only means of providing health care.

### **3.3.3 Actors in the Health Care System**

The medical profession is of course not the only player in the health field. Freidson (1970) believes professional dominance is the main cause of problems in health care, but Alford (1975) for example, argues that the explanation of inequities are founded in the continuing struggle between the main actors, or structural interests, in the health care system.

Forms of health care organization, and the conflicts and distribution of benefits that ensue, reflect the structural location *vis a*

vs each interest group and the power play that takes place between them. Alford (1975) identified three key interest groups:

**(1) *Dominant Structural Interests:***

These comprise the Professional Monopolists whose dominant interests are served by the prevailing structure of social, economic and political institutions. Existing institutions protect and reinforce the logic and conditions of the professional monopoly over the production and distribution of health services. The dominant group therefore does not have to continually organize itself and act to defend its interests. The professional monopolists control all major health care resources. Professional monopolists are essentially represented by the medical profession - the doctors and specialists in both private practice and salaried positions, biomedical researchers, the medical academic elite, and other professional occupational groups who hold positions in hospitals, medical schools, universities, government and non-government health agencies.

**(2) *Challenging Structural Interests:***

These represent the views of the Corporate Rationalizers who challenge the power and dominance of the medical profession by demanding technocratic expert control of the system through rational planning. Corporate rationalization is a new structural element created through the changing technology and division of labour in the production of health care. The corporate rationalizers are the bureaucrats of the health care organization e.g. hospital

administrators, deans of medical schools, health planners, and public health officials. Their structural interests aim to break the professional monopoly of doctors over the production and distribution of health care. However, much of the conflict is contained within an institutional framework which prevents corporate rationalizers from obtaining sufficient societal power to integrate and co-ordinate health service provision.

### **(3) *Repressed Structural Interests:***

These are the interests of the Community Population - the basic users of health services. This group seeks to move out of its repressed position usually by articulating its interests through health advocates. Equal health advocates seek free, accessible, high quality health care which equalizes treatment available to all potential patients and consumer groups. Repressed structural interest groups stress the importance of community control over the supply and deployment of health resources. They argue health strategies should be based on the interests of local populations since they are the ones actually in need of and are affected by health service provision. These interests are opposite to dominant structural interests although not not necessarily always in conflict with them e.g. health insurance schemes. Institutional arrangements guarantee repressed structural interests will not be served unless extraordinary political energy is mobilized by the community. Since no political mechanism exists to ensure repressed interests are served, and community populations cannot organize themselves into interest groups as easily as the other two elements, efforts by their advocates are likely to fail (Alford, 1975; Waitzkin 1978; Ham, 1983).

The outcomes of the health system reflect the fundamental difference between these structural interest groups and their political and organizational influence. The professional monopolists and the corporate rationalizers are the funders and providers of health care. Doctors are the most powerful group. Their influence has been discussed above, but there are several additional points that should be made here along with comment on the other two groups.

The professional monopolist element like the other two structural interests, is not internally homogeneous. Professional control over the conditions of work and medical manpower supply, has lead to intensive specialization within medicine. Power is unevenly distributed among the membership of the profession. Conflict arises between specialty groups over their areas of jurisdiction and reward. Internal divisions also occur in the awarding of distinctions and prestige. The number of specialties has resulted in fragmented and often insensitive patterns of care. It has also produced budgetary infighting and the imposition of priorities for resource allocation.

There are thus two dimensions to the professional monopolist's power: (1) the total power they command with respect to the corporate rationalizers and community populations; and (2) recognition that some professional interests can utilize this power more effectively because of their status within the profession (Eyles and Woods, 1983). According to Alford (1975), the battles that exist between the various factions of the medical profession occur within the dominant structural interests and therefore do not challenge the



principles of their monopolistic powers. All specialties share the common interest of maintaining professional autonomy and control, regardless of internal conflicts.

Corporate rationalizers adhere to a technocratic-bureaucratic ideology which sees them performing the core functions of financing, organizing and distributing health care resources. Medical practitioners and allied health professionals perform the crucial work tasks but in their proper places as subordinates in the health care system which is co-ordinated and operated by the bureaucrats. The corporate rationalizers become powerful through their control over the organizational environment. They achieve this by asserting that their organizational measures can guarantee medical performance and quality of care more effectively, more economically and more evenly, than the legal requirements imposed on individual medical practitioners. They also increase the proportion of medical positions that are salaried, thus circumscribing the power of medical specialists by reducing them to employee status. Furthermore, corporate rationalizers control the availability of important equipment and facilities.

In order to acquire more resources and extend their domain of influence, corporate rationalizers may ally themselves to the professional monopolists within their own institutions. In such circumstances, the bureaucrats attempt to maintain control over the expenditure of funds, the conditions of work and the division of labour power. Alford describes the doctor-hospital relationship as symbiotic involving both intrinsic dependency and conflict.

Ideally, corporate rationalization, as in Health Maintenance Organizations, can produce an effective co-ordinated, integrated, rationally planned and efficient health service. In reality, much planning fails because the corporate rationalizers are unable to control all the factors involved in the production of health care. Organizations may have the ability to integrate their own services but they cannot extend this to all levels of institutional and community care. Alford suggests "bureaucratic organizations typically in market economies can rationally and efficiently serve those clients or customers within their defined and limited jurisdiction who possess the proper keys (money, legal claim, membership in a status group etc.) to open the door to their services, but have no incentives or structural imperatives which can broaden their specific means and goals" (1975, p206).

Even though different organizational interests will often have to compete against each other for resources, they all share the belief in extending bureaucratic control over the dominant structural interests. However, the overall effect of corporate rationalization in the health sector is to increase and complicate both public and private bureaucratic health care structures.

The third element, repressed structural interests, is extremely heterogeneous. It represents a large number of groups within the community who may or may not have the potential to organize and express their own wishes. Community populations tend to be most active at the local level, mobilizing their forces in response to particular health care projects, local health issues and health needs. Pressure group politics and community power

struggles at the local level exist within the overall structural interest. Many diverse community interest groups can enter the political arena and conflict between these interests develops during the processes of negotiation over the assignment of priorities, funding, timing, site selection, areas of responsibility and so forth. The diversity of repressed interests may mean that a number of community pressure groups have to be taken into decision-making processes. Each will exercise their allotted voting rights depending on whether the outcomes will be favourable or adverse to their interests. However, the consequence of this type of political action for the provision of health services is a strong tendency to maintain the status quo (Krause, 1977).

Unless community populations can unite their efforts, community participation in policy- and decision-making processes is not threatening to the dominant and challenging structural interests. In fact most attempts by community groups to improve the quality and/or quantity of available health care, are not likely to succeed. In general, community pressure groups do not possess the necessary information nor the ability to play an important political role. They have neither the access to necessary political processes and institutional operations, nor the political resources needed to acquire such information (Alford, 1975). As Krause (1977) points out all consumer and professional action has grown up and takes place within the existing institutional framework. Dominant and challenging structural interests are capable of compromising and co-opting consumer participation to protect and legitimize their own positions. Without any real changes in the relations of power, the co-option of community leaders to health advisory boards, management

committees, planning tribunals, and the like, is just a symbolic representation of repressed structural interests in policy- and decision-making. Representatives of the community groups in New Zealand currently possess little political leverage to threaten the status quo.

The professional monopolists can also seize upon consumer demands to support and legitimate new projects which are of particular interest to them. The medical profession provides a symbolic screen of legitimacy while maintaining power. "A continuous flow of symbols will reassure the funding or allegedly controlling publics or constituencies about the functions being performed while the individuals or groups which have a special interest in the income, prestige, or power generated by the agency are benefiting from its allocation of resources" (Alford, 1975, p194). The net result is a proliferation of highly specialized projects which may or may not satisfy the original consumer demands.

Alford summarizes this argument on health care politics by stating "the 'crisis' of health care is *not* a result of the necessary competition of diverse interests, groups, and providers in a pluralistic and competitive health economy, nor is it a result of bureaucratic inefficiencies to be corrected by yet more layers of administration established by government policy. Rather, the conflicts between the professional monopolists, who seek to erect barriers to protect their control over research, teaching, and care, and the corporate rationalizers, who seek to extend their control over the organization of services, account for many of the aspects of health care" (1975; p251).

Conflicts in health care can be located in more fundamental social contradictions that arise through the private appropriation of power and resources. Alford argues health care reform is unlikely without the presence of wider social and political change. Navarro in responding to work by Alford and others, argues that the focus on the health sector and apparent unawareness of class struggle, limits the explanatory value of their theories. "The main limitation of the power elite theories is their failure to recognize that those elites are in reality segments of a dominant class and that when they are considered in a systemic and not just a sectorial fashion, they are found to possess a high degree of cohesion and solidarity, with common interests and common purposes far transcending their specific differences and disagreements" (Navarro, 1976, p189-90). Navarro's main argument is that in order to understand the behaviour and dynamics of the actors in the health sector, their positions and functions within the overall political and economic structure of society have to be understood.

The failure of State policies on health often results from a failure to recognize the importance of the local medical hegemony and the local political agenda which has been largely governed by the medical profession. By the time State initiatives have been put into effect at the local level, they have been amended and adjusted to meet the political views of the local agencies (Eyles and Woods, 1983). Central government's inability to effectively influence health at the local level often reflects the lack of awareness and appreciation of the importance of the medical profession at this level.

### 3.4 TOWARDS AN ACCEPTABLE EXPLANATION

Even though both managerialism and Marxist interpretations (Chapter Two), offer a great deal to the analysis of conflicts and socio-spatial structures, neither provide a complete explanation of phenomena such as health care or housing. Each approach is characterized by logical, methodological and epistemological weaknesses. It is argued that neither stands alone in its present form as an acceptable all-embracing explanation of the social environment and problems created by the development and spread of capitalism.

Like Weber and Marx, today's researchers are unified by the altruistic concern for developing a more equitable and a better form of social organization. Two basic assumptions that there will always be scarce urban resources and facilities, and that their control and distribution will always be a contentious political issue, are central to the thinking within modern urban studies. Over recent years, geographers have become less concerned with distributions *per se* and have increasingly turned their attention to structural inequalities that such distributions reveal and to the processes that sustain them (Pahl, 1979B). Pahl (1979B, p43-4) states, "Whether the position I adopt is termed managerialist, corporatist, or something else is less important than the essential understanding that specific agents ultimately control and allocate resources...Geographers who want to understand why the scarce resources are distributed as they are will not get the answer from the distribution in themselves, although they may certainly provide some clues. Allocations are made by agents in organizations... Someone has to invent rules and apply them: no

matter what the macrostructure, the socio-political processes of intra and inter-organizational conflict will prevail...". In challenging the Marxist perspective by saying monocausal answers will be increasingly unlikely, Pahl (1977) suggests that those people interested in social problems should never be far from the practical questions of who gets what, who determines 'who gets what', and what determines 'who determines who gets what'.

Pahl's managerialist thesis derives its greatest value from empirical studies undertaken at the level of the local interface between allocators of resources and individual consumers. Managerialism has revealed much about the nature of allocative processes and the role of system managers. Although it recognizes the fact that these allocators and managers operate within constraints set by wider societal influences and act as middle-dogs rather than independent autonomous units, it has to a large extent failed to broaden its analyses to the macrostructure of society which in the case of medicine is very important. As Williams (1982) states the managerialist or institutional approach becomes appropriate if it is set within the context of a broader and deeper political and economic perspective of society. In order to understand the actions of the managers and the operation of organizations at the local interface, it is necessary to trace from the local level the hierarchy of constraints and policy formulations up to the national level.

The Marxist urban perspective has offered an attractive alternative in the understanding of health issues. It naturally focuses on questions of power and conflict, on relations between individuals and groups, and on processes of economic development. The overall

aim of the Marxist approach is to expose broad structural relations and forces underlying the established social formation and surface manifestations of social conflict within advanced capitalist societies.

However, radical research has been remiss in ignoring or dismissing institutional and managerial influences in their explanations of social development and conflict. Williams (1982) suggests that to omit this level of action leads to an oversimplified and highly functional view of the social system. Indeed, one of the major criticisms of Marxist interpretations of the urban system is their failure to account for local variations and wide differences in and between capitalist societies in their economic structure, political organization, and the power and autonomy of the state. The main challenge facing radical social geography is the structural analysis of 'middle-order' organizations and institutions. In order to provide an adequate explanation of phenomena such as health care, Marxist analysis must be able to interpret the actions of 'urban managers' and analyse the various resultant spatial and social outcomes. The problem remains then for Marxist urban geographers to refine their analyses.

Organizations are complex structures in which a variety of processes come to bear. These processes are changed and manipulated within the inter-organizational network. Leonard (1979) argues that research outlining power relations at high levels of state bureaucracy is meaningless in terms of spatial injustice unless the relations are traced through all levels of policy formulation where individual, organizational and institutional goals may distort original policy objectives, right down to the final interface between the local



government official and his client where prejudice and bias may negate the intention of the original initiative. It cannot be assumed that processes operating in one area operate in the exact same way in another, and thus it cannot be assumed that the broad economic, political or ideological relations existing in capitalist societies will produce the same urban outcomes in different areas.

Clearly, different forces and processes operate at different levels of society, and this does suggest the need to assume different analytical approaches, although by no means different philosophical stances. It is believed that an amalgamation of elements of the managerial and political economy approaches presents a realistic and acceptable explanatory framework for investigating phenomena such as health care and housing. As each approach seems to exhibit strength in areas where the other is weak, it would appear simple enough, akin to Saunders (1981) suggestion, that the managerialist approach could be applied at the local level and Marxist political economy perspective at the macrolevel of society. The danger of making a simple dichotomy such as this, is that although the analysis seeks to provide a complete explanation, it is philosophically inconsistent since managerialism draws on Weberian ideas and the political economy approach is based on Marxist concepts. The merging of managerialist and Marxist perspectives would be illegitimate unless fundamental and central philosophical differences are first reconciled.

A comprehensive understanding of health care as put forward in this and the preceding chapter, argues that either the managerialist perspective be situated in the broader context of

economic, political and social constraints, and the relationships between the urban managers and wider societal forces are expanded upon, or starting from the Marxist perspective of society, the expression and execution of basic relations at the level of empirical analysis are more fully specified and greater attention is given to explaining how outcomes are achieved in reality. This includes greater specification of the role of organizations and individuals in key bureaucratic positions.

The impact of managerialism and the structural nature of health care on patterns of hospital utilization are the focus of the next chapter.

# **CHAPTER FOUR**

## **ORGANIZATIONAL DETERMINANTS OF HOSPITAL UTILIZATION**

### **4.1 INTRODUCTION**

Patterns of health services utilization have traditionally been explained in terms of individual behaviour. This thesis contends that such an approach provides a limited explanation of utilization phenomena because it ignores the factors that condition individual behaviour. Past research has largely failed to appreciate the significance of the health care delivery system in determining the opportunities for health services utilization and the constraints placed on individual user behaviour.

Within the context of Chapters Two and Three, this Chapter now examines in detail, the pattern of influence exerted over hospital utilization by the health care delivery system via the supply and organization of resources. The Chapter is specifically concerned with hospital utilization, but the discussion has wider implications in the understanding of health services utilization in general.

The behavioural approach as a mode of explanation is reviewed initially to provide an understanding of the basic behavioural processes and 'individual' determinants involved in health services use. The Chapter then concentrates on the two specific themes of

the thesis: (1) the impact of the supply of health care resources on hospital use. The discussion centres on the concept of supply induced demand and Roemer's Law of hospitalization; and (2) the organization and operation of the health services system. This deals particularly with the managerial functions of doctor 'gatekeeping' and patient referral to hospital and other services. A summary of health system determination of patterns of utilization is provided in Section 4.4.

The Chapter brings the discussion presented in Chapters Two and Three into the realm of empirical research. By identifying factors important in the explanation of patterns of utilization, the discussion sets the methodological background to the research on diabetes hospitalization.

## **4.2 BEHAVIOURALISM**

All health services are united by the fact that they represent society's attempt to satisfy individual and community health needs. The State, through public or private health services, provides its citizens with the opportunity of accessing health care, but access has to be realized if potential benefits are to accrue. The identification of health needs and the translation of these into use of services are complex behavioural processes - processes that are firmly embedded in the structure and functioning of society.

The behavioural approach gained ascendancy in geographical thought on health care through the general dissatisfaction in human

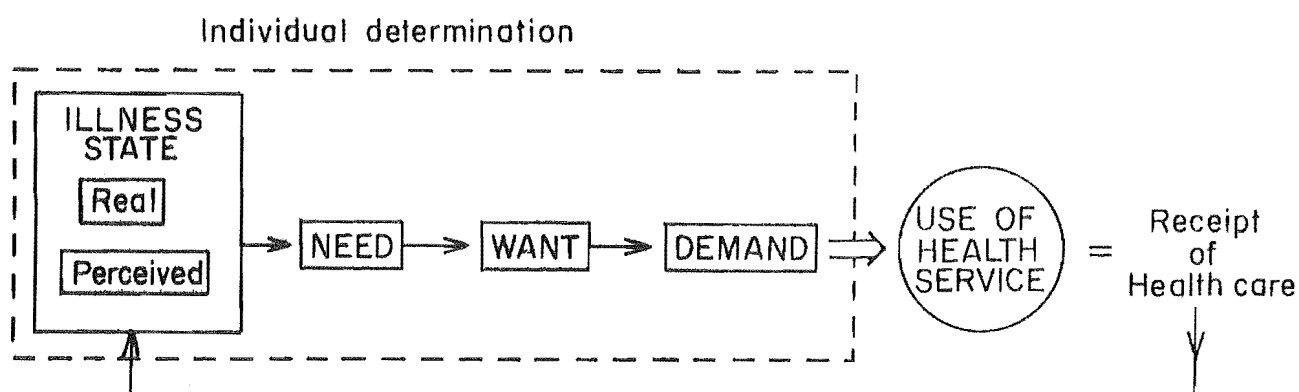
geography with the ability of locational analysis and economic determinism to adequately explain spatial and social phenomena (see Joseph and Phillips, 1984, for discussion on locational interpretations of health care accessibility and utilization). It was believed that greater insight could be gained from specifying an individual's spatial behaviour in seeking health care, given that sufficient information about their thought processes which influence revealed behaviour was known (Mayer, 1982A and B). Explanations of health care behaviour founded in sociology and psychology became attractive alternatives to locational analysis. Health care users did seem to behave differently, and for a variety of reasons. Research embodying aspects of behaviouralism was soon adopted into medical geography (Howe and Phillips, 1983).

In the 1960s, the study of individuals and households was implicitly believed to provide the key to understanding the social environment (Gray, 1976). Under phenomenology, individuals were given a primacy in analyses through the belief that they controlled and determined their own existence (Herbert and Smith, 1979). In behaviouralism, people are seen to exercise individual preferences from within choice frameworks, but rather than choosing optimizing strategies, they choose alternatives that maximize satisfaction (Marion and Flowerdew, 1982). Health status or access to health services, would, for example, be judged satisfactory or unsatisfactory by individuals depending on their knowledge and aspirations (Eyles and Woods, 1983). People's actions reflected their perceptual or cognitive differences in how they saw and responded to the environment in which their actions were undertaken (Gray, 1976).

In health services research, attention became focussed on the meaning and definition individuals gave to illness, doctor-patient interactions including the attributes and expectations of both patient and doctor, patient compliance, and social attitudes towards and satisfaction with different health care settings (Eyles and Woods, 1983). The behavioural perspective attempted to broaden the understanding of health issues by expanding the awareness of the roles that people's attitudes and behaviour played in the perception of illness and in the seeking of medical care.

The behavioural process involved in seeking health care can, in simplistic terms, be conceptualized as a sequential shift through the inter-related stages of an initiating illness state, need, want, demand, and receipt of care (Figure 4.1) (Bradshaw, 1972; Girt, 1973; Hershey et al, 1975; Joseph and Phillips, 1984). The event that precipitates health care behaviour may be 'real' or perceived, and may relate to past, present or future health problems. Real morbidity is a health state that is universally recognized, and approved by the medical establishment, as constituting ill-health. This implies the existence of either some pathological or structural state, or some abnormal psycho-biological functioning. The health care process is, however, usually initiated through symptoms of the individual (perceived morbidity). Since this involves subjective interpretation and evaluation of illness, perceived morbidity does not necessarily correspond with an individual's real health status.

Care is predominantly sought in relation to current illness events, but people also use health services for follow-up and preventive reasons. These latter instances involve different behaviour in terms of the evaluation of illness and need for care. Need (Stage II) is the response to the precipitating illness state. Health problems are evaluated in terms of their requirements for some form of medical intervention. If problems are perceived to be sufficiently serious then individuals will derive need for care. Girt (1973) defines this process of identifying and evaluating illness as 'illness-behaviour'.



**Figure 4.1:** A Behavioural Model of the Health Care Process.

The third stage of the model represents want or felt need. Want specifically denotes an individual's desire to use professional medical services. The utilization process is effectively terminated after Stage II if the need for care can be satisfied outside the formal medical sector through the use of non-prescription drugs, rest and recuperation and alternative forms of health care for example. Stage IV represents demand. Girt (1973) defines the translation of want into demand as 'therapeutic behaviour'. People demand health care when they physically seek medical treatment.

Thus, the probability of an individual using a health service is conditional on the probability of translating each of the above stages into the next. Reaching Stage V implies necessary decisions have been made and all intervening barriers to care overcome. Although efficacy of health services is a controversial area of debate, it is assumed in this simple conceptualization that utilization implies receipt of care.

Patterns of health services utilization do, however, depict revealed access because not all individuals are able to translate need for care into service use (Joseph and Phillips, 1984). Basic differences in perception of need, together with social, financial, spatial and organizational barriers to access, prevent everybody in 'need' from obtaining medical care. This underlies patterns of social inequality. The provision of medical resources tends to exacerbate health inequalities because services are traditionally distributed according to patterns of expressed want and demand, which do not necessarily reflect need.



A number of explicit models have been developed to describe and predict patterns of health services use. As Veeder states, utilization models became "sensitive to the role of psychological states, social group pressures, motivations, beliefs, and institutional barriers to service utilization" (1975, p101). The main constructs of these behavioural models are identified below. For more detailed discussion see, for example, Veeder, 1975; Stimson, 1981; or Joseph and Phillips, 1984.

Rosenstock's conceptualization of health care behaviour emphasizes the importance of psychological-motivational factors in determining people's use of health services (Rosenstock, 1966). Rosenstock's health belief model argues that emotional aspects of people's beliefs and attitudes dominate cognitive and rational thought. The readiness of individuals to act upon certain health cues, reflects their susceptibility to illness, interpretation and evaluation of their state of health, and attitudes and beliefs about health care. For example, only when impairment in functioning becomes so great or obvious will some individuals demand health care. Until that time arises, they deal with issues thought to be more important (e.g. employment, housing, personal relationships) and their health problems remain in the background.

While psychological factors are important, interpretations based on Suchman's model (Suchman, 1966), posit that it is socio-environmental factors that govern individual behaviour. Use of health services reflects individual knowledge, availability and convenience of

services, but more importantly influences arising from the social group to which individuals belong. Suchman argued that groups which are socially isolated but relatively homogeneous and cohesive, react to illness and medical care in terms of social group definitions and interpretations of appropriate behaviour. Different ethnic and socio-economic groups, for example, differ in their knowledge of disease, what is acceptable behaviour during illness, their attitudes towards health care, and ability to access and pay for care. These social group influences reflect in disparate levels of health services utilization (e.g. DHSS, the Black Report, 1980; Davis, 1981).

Perhaps the most common framework for viewing individual determinants of health services utilization are adaptations of Anderson's family life-cycle model (Anderson, 1968; Gross, 1972; Andersen and Newman, 1973; Aday and Andersen, 1974; Aday and Andersen, 1981). A sequence of three conditions contributes to the use of health services: (1) the predisposition of a family or individual to use services; (2) their ability to secure services; and (3) the need for care. Use is dependent on predisposing, enabling, and illness factors:

**(1) *Predisposing Factors:***

Individuals have different propensities to use health services which can be predicted by personal characteristics existing prior to the onset of illness. These include demographic, social structure, and psychological (health belief) characteristics. Predisposing factors *per se* are not reasons for seeking health care, rather they give rise

to different susceptibilities to illness and inclination towards using health resources. For example, age is an important predictor of illness and utilization.

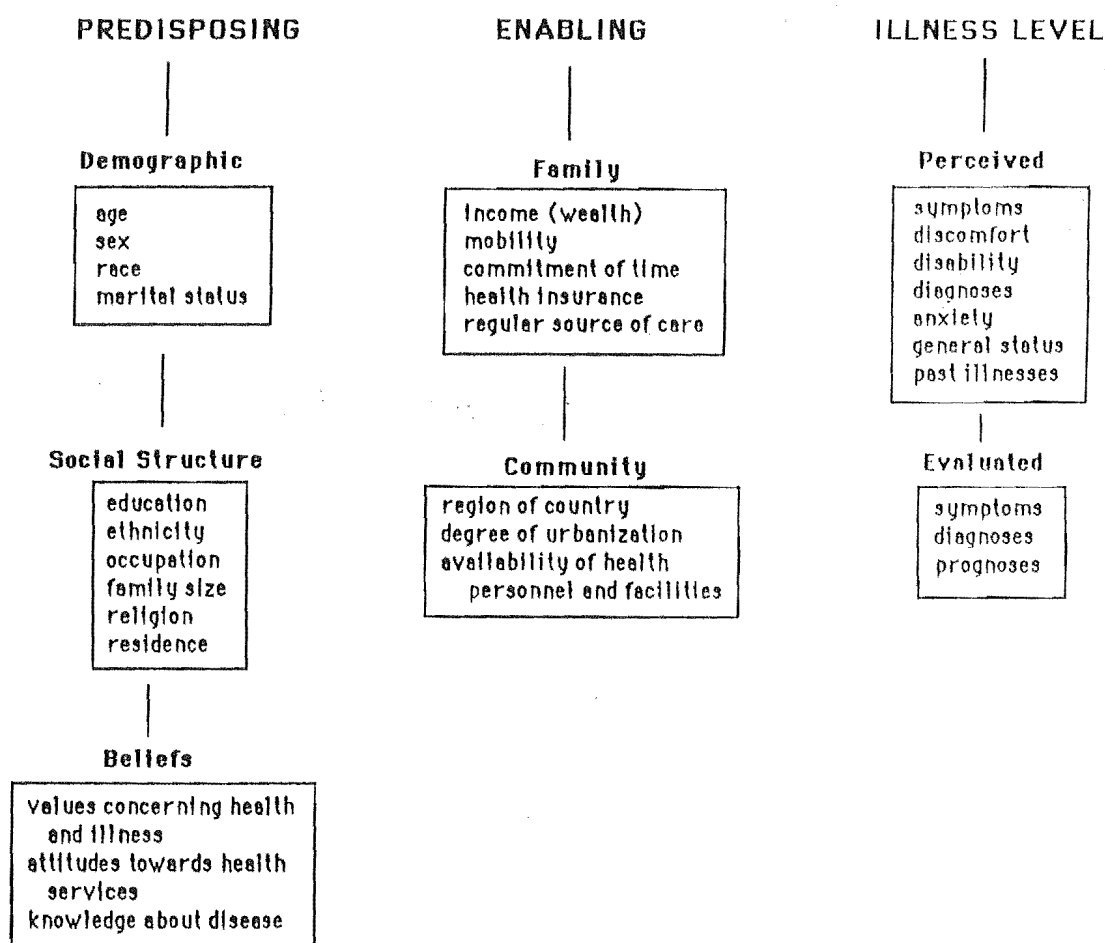
## **(2) *Enabling Factors:***

These essentially define an individual's ability to secure health care. Individuals may be predisposed to using health services but they still have to perceive that services are accessible to them and have the means to facilitate their use. Enabling factors impede or facilitate the translation of health care wants into effective demand. Therapeutic behaviour is largely influenced by economic factors, particularly a family's ability to finance care by meeting the direct, indirect and opportunity costs involved, and in terms of the expenditure of time and effort. The level of health resource availability within a community, the price of health care, and access to a regular source of care are also enabling factors.

## **(3) *Illness Level:***

The illness state is the basic reason for seeking health care. As discussed earlier, perceived morbidity, whether or not it corresponds to the 'true' psychobiological state, is the force motivating health care behaviour. Different interpretations of the health state can be included as utilization determinants.

The diverse factors involved in these three dimensions are summarized in Figure 4.2. The importance of predisposing, enabling



**Figure 4.2:** Individual Determinants of Health Services Utilization.

and illness factors depends on individual or family discretion. People can exercise a degree of choice over their actions, but their behaviour is constrained by individual limitations and restraints in their environment. For example, individual health care behaviour is most obviously constrained by the individual's physical condition.

Criticism has been levelled at the behavioural approach in health care on both methodological and conceptual bases. Much of the early research was impressionistic and failed to produce quantitative information on utilization patterns (Bice et al, 1972). Veeder (1975) suggested many behavioural studies lacked methodological rigour, and that while many variables were identified as determinants of use, their relative importance was disputed (as evident in the above discussion). The incorporation of numerous variables in the explanation, although improving statistical explanation, contributed little to the understanding of the processes involved. Demographic factors were, for example, shown to have strong predictive properties but they did not necessarily reveal in any great depth why variations in utilization occurred (McKinlay, 1972).

Such methodological criticism was eclipsed by the more profound questioning of the basic constructs of behaviouralism. This approach developed as a reaction to the lack of realism in previous modes of explanation, but behavioural geography has also been criticized for misdirecting and limiting the interpretation of socio-spatial processes. Behaviouralism is based on the primacy of individual freedom, preference and choice, but clearly, individuals and families are not free to choose where they wish to live or what

health services they might access. Studies failed to examine what determined people's choice frameworks - the set of alternatives among which individuals were choosing in order to maximize their utility (Marion and Flowerdew, 1982). Unless preference and choice were set within the context of constraints on individual access to resources and facilities, then the value of the work became greatly diminished.

Social and territorial injustices exist because power and wealth are unevenly distributed within society. As stated in the two previous Chapters, access to resources has increasingly been seen to be determined by the relationship of individuals to the various allocative systems whose operations generate constraints on behaviour, and by the wider social, political and economic conditions of society. Factors of managerialism and the political economy were the underlying and missing variables in the socio-spatial configurations which behaviouralism had attempted to explain in isolation. Gray's summary of the housing market provides an apt description of health care:

"Individual households are actors (in a play designed and produced by capitalism) whose actions are constrained by a stage managed by the 'urban gatekeepers'" (Gray, 1976; 231)

The pre-occupation with individual user characteristics has persisted in the study of health services utilization. It would be incorrect to suggest that factors pertaining to the delivery of care

were ignored in the behavioural approach, but their importance was subsumed in relation to individual behaviour. The health care delivery system was essentially viewed as being ideologically neutral. The relationship between health problems and health services was unidirectional - health needs were the stimuli and services the reaction. The provision of health services was simply viewed as society's response to health needs. Any adverse effects that the health services system exerted on utilization resulted from imperfections in health care organization, resource availability and distribution.

Most researchers worked within conceptual boundaries that prevented them from realizing that the financing and organization of the health services system had major importance, if not dominance, in determining patterns of health services utilization. As attention continued to concentrate on individual attributes, the impact of health services, in determining the framework in which health care behaviour occurred, remained unexplored. Medicine was not seen as a social institution with its own political agenda and objectives.

### **4.3 SUPPLY INDUCED DEMAND FOR HOSPITAL CARE**

Findings of small area studies and cross-national comparisons show that variations in health services use are not entirely, if at all, attributable to differences in demographic and socio-economic factors, or to patterns of morbidity and medical need (e.g. Kekki, 1980; Connell et al, 1981; Rothberg, 1982; Wennberg and Gittelsohn, 1982; McPherson et al, 1981; Dutton, 1986; Wolfe,

1986). Per capita use of health services varies markedly between neighbouring areas that have similar population characteristics and need for care, and international differences between Western countries in their use of hospital resources relate more strongly to differences in the provision of health care than to any major difference in the character of their populations.

It is argued that the explanation of many patterns of health services use can be found in the concept of supply induced demand for health care. Over twenty-five years ago, Milton Roemer (1959, 1961) tried to draw attention to the factor that he believed more than any other determines utilization of hospital resources in any community, region or country. He was referring to the supply of available hospital beds. Roemer believed that health care delivery systems, or components thereof, have the capacity to manipulate consumer demand for their services independent of basic population factors.

Recent studies confirm that positive relationships exist between the availability of resources and rates of hospital use (e.g. Barnett et al, 1980; Kekki, 1980; Ginsburg and Koretz, 1983; Rosenblatt and Moscovice, 1984; Malcolm, 1987). This inducement phenomenon, by no means, solely applies to the secondary sector. Use of primary care services has also been found to relate directly to the availability of general practitioners (e.g. Hart, 1971; Barnett and Sheerin, 1978; Knox, 1978; Knox, 1979; Malcolm et al, 1980; Stimson, 1980; Phillips, 1981; Hyslop et al, 1983).



#### **4.3.1 Institutional Behaviour of (Public Non-Profit) Hospitals**

An important element of the supply induced demand theory is the institutional behaviour of hospitals in manipulating consumer demand in the pursuit of their organizational goals. These goals reflect the different functions of each hospital. The multi-facet nature of hospitals is well illustrated by the diversity of descriptions applied to them. Hospitals can be stratified by size, range of services provided, mix of cases, style of practice, technical sophistication, teaching status, location, and by type of ownership and financial orientation. Irrespective of their type, hospitals will act as institutions and their behaviour towards consumer use will be governed by their organizational objectives and arrangements.

Public (state provided) hospitals, as opposed to either voluntary non-profit or private (for profit) hospitals, have been likened to non-profit multi-product firms that supply a variety of goods and services to their local communities (Hornbrook and Goldfarb, 1983). While policy is a function of the overall governing board, the day-to-day objectives and activities of the hospital are determined in the large part by the medical professional staff and the hospital administrators. The managerial staff attempt to maximize the objectives of the hospital within the different constraints placed upon their institution.

The hospital's product is heterogeneous and can be defined in a number of ways. A service-mix approach which focuses on aspects of supply, details, for example, the character and range of facilities and

services provided or actually performed. In contrast, the case-mix approach identifies the hospital's specialty and diagnostic case-load which reflects the nature of local demand (Tatchell, 1983). Hospital output may be measured in terms of discharges (admissions), number of operations, average length of hospital stay, patient days, or bed occupancy for example.

As a public institution, the state run hospital, as in New Zealand, will attempt to maximize utility rather than profit (the latter being the objective of private hospitals). Public, voluntary and private hospitals each derive their overall objective function from assigning different preference to financial and patient-care oriented goals. This involves a choice between such things as the hospital's net operating revenue surplus, total admissions, level of emergency stand-by capacity, diagnostic mix of patients admitted for treatment, quality of patient care, and style of medical practice indicated by the type of care the hospital prefers to provide (Hornbrook and Goldfarb, 1983). The balance between these factors will clearly differ between public, voluntary and private hospitals.

Each hospital will pursue its chosen objective function within the organizational and societal constraints placed on its behaviour. Public hospital activity will, for example, be constrained by the health needs of the population within its designated catchment, the availability of alternative sources of care within its service area, and the local community's and State's ability and willingness to finance and support hospital care.

All hospitals act in an organizational manner in responding to the level of resources available to them from their organizational environment, and to the level of diversity and complexity of demand for their services. Hospitals typically make trade-offs between their institutional goals in response to shifts in production technology (level and mix of capital and labour) and to wider economic and political influences.

In current economic climates hospitals in both non-profit and private sectors, have been forced to pursue organizational strategies which ensure their survival but which are not necessarily in line with their basic objectives (Hornbrook and Goldfarb, 1983; Smith and Sutton, 1984; McLafferty, 1986; Report of the Hospital and Related Services Task Force, 1988). In circumstances, like financial stress and pressure from the full employment of limited resources, both non-profit and profit hospitals may be characterized by the same types of institutional behaviour and outcomes, even though different processes and incentives will be operating in each sector (McPherson et al, 1981; McLafferty, 1986). For example, hospitals will attempt to induce consumer demand via diversification, expansion and differentiation of their services and functions (Comstock and Schrager, 1976; McPherson et al, 1981; Roach, 1982; McLafferty, 1986). They also attempt to reduce costs through, for example, limiting access to indigent sectors of the population, introducing diagnostic related groups, abandoning 'uneconomic' technical, laboratory or treatment procedures, terminating outpatient or extra-mural services, and merging or closing wards and hospitals (McLafferty, 1982; Hernandez and Kaluzny, 1983; McLafferty, 1986).

Hospitals identify their domains of activity and attempt to solidify their position in the community and in the health care organization.

Basic laws of supply and demand do not work in the health sector for two main reasons: first, consumer sovereignty over consumption decisions is not maintained; and second, the 'sellers' of medical care also act as agents for the 'buyers' (Fuchs and Newhouse, 1978; Wennberg et al, 1982). Four conditions must be satisfied for rational consumer choice: (1) consumers know what they need; (2) consumers know the effectiveness and quality of various goods and services in attaining what they need; (3) consumers know the price of such goods and services; and (4) consumers use this information to maximize their total satisfaction (Wennberg et al, 1982). These conditions are not met in the health sector.

Much of the decision-making with regards to using health services has been relegated to, or procured by, the professional monopolists from the consumer population. Potential patients (the consumers) lack information on which to base their decisions and the information they do have access to is largely biased. There is difficulty in the identification of health needs, in articulating wants, and in discerning the effectiveness of health services and health care products in meeting need. Furthermore, the character of the health care system prohibits potential users from usually ascertaining the real price of services. Individuals do not necessarily know the lowest price and are therefore unable to make informed decisions in order to maximize utility.

Maximization of consumer utility is dependent on physician behaviour. Doctors are the providers and sellers of care, but they also act as agents for their patients who are the buyers. Rational agency behaviour will be discussed shortly, but through the control of information and delegated decision-making, consumer satisfaction is not derived from rational consumer choice in the health care market, but from the behaviour of the health care delivery system. Traditional market forces do not operate to produce optimal provision and utilization of resources.

The over-supply of a key commodity, such as hospital beds or general practitioners, does not necessarily produce a reduction in the cost of health care (O'Donoghue, 1976; Fuchs and Newhouse, 1978). Excess supply tends to be absorbed into the market through the generation of new demand for care at the prevailing price, especially if care is subsidized by third party carriers or the government. Shifts in demand functions occur even when demand exceeds objectively demonstrable need (Rogatz, 1974; Fuchs and Newhouse, 1978). There are, however, limits beyond which excess bed supply or medical manpower can no longer be tolerated, and some ward and hospital closure will eventually occur (McLafferty, 1982; McLafferty, 1986). A similar situation also occurs in primary care with doctors being forced to locate in less desirable areas (Newhouse et al, 1982; Health Benefits Review, 1986; Barnett, 1988).

### 4.3.2 Bed Supply and Hospitalization

In sharp contrast to the view that patterns of hospitalization reflect individual behavioural determinants there is the theory that supply creates its own demand, and that much of the variation observed in hospital use can be explained by the institutional and organizational behaviour of the health care system. As stated earlier, the positive relationship between the supply of hospital beds available to a community and rates of hospital use was first posited by Roemer (Roemer and Shain, 1959; Roemer, 1961). This relationship is commonly referred to as Roemer's Law.

Despite the significance of Roemer's work, it has only been recently with fiscal crises in the provision of health care resources, that attention has focused on factors of supply. Roemer and Shain (1959) had in fact reported nearly thirty years ago, three key observations on hospital utilization:

- (1) hospital beds that were built tended to be used,
- (2) the more hospital beds provided in a community, the more days of hospital care used, and
- (3) general hospital beds are occupied at about the same rate, regardless of whether there were few or many beds per capita.

These findings were reinforced by Roemer's study of changes in hospital use following the commissioning of a new hospital in an area that was already well served by medical care. Roemer (1961)

reported that the number of admissions, the average length of stay, and total patient days all rose substantially after the new hospital was opened. The county population had changed very little, and there was no reason to believe patterns of morbidity had altered, yet hospital utilization increased by 28 percent in the three years following the increase in bed supply. Roemer argued that the local doctors in response to the new hospital were more likely to hospitalize patients, and once they were admitted, were more likely to prolong their hospital stay. Roemer states, "these findings would seem to add up to the simple conclusion that the number and type of hospital beds materially influenced the practice of medicine in the study hospital" (1961, p41).

These findings on hospital and doctor behaviour have been reproduced in a number of more recent studies. For example, Feldstein (1971), who deliberately tested the economic hypothesis that a change in supply could induce a shift in demand, found that a 1 percent increase in hospital beds produced a 0.53 percent increase in days of hospitalization. Ginsburg and Koretz (1983) observed a similar relationship when they attempted to discount the effects of price changes from changes in bed supply by examining hospitalization of Medicare patients. They found, all else being constant, a 1 percent increase in per capita bed supply produced an increase in total days of care per 1000 Medicare enrollees of 0.42 percent.

Two studies have documented the existence of Roemer's Law in New Zealand's hospital system. Barnett, Ward and Tatchell (1980)

examined the relationship between public hospital admission rates and public bed supply per capita after adjusting for inter-regional flows of patients. They found that the demand for hospital care, as revealed by hospital admissions, was quite highly related to bed supply ( $r=0.605$ ). However, the availability of resources was poorly related to medical need as measured in terms of demographic factors and infant mortality. In other words, area variations in rates of hospital use tended to reflect the availability of hospital beds rather than underlying differences in the need for care.

In the second study, Malcolm (1987) examined the association between the availability and utilization of mental illness and mental handicap beds in New Zealand. Although both the supply and use of these beds varied greatly between the hospital board areas studied, bed availability per 1000 population was correlated strongly with both the rate of admission ( $r=0.78$ ) and total bed days ( $r=0.98$ ). What was of particular concern to Malcolm, was the possible detrimental effects of institutionalization in areas with above average bed supply. It seemed that a ready availability of beds led to greatly increased numbers of admissions and prolongation of hospital stay, thus fostering dependency, and as a consequence an expensive and poor quality mental health service (Malcolm, 1987).

Roemer's Law has been interpreted in two ways: first, increased hospitalization, following increased bed supply, reflects a true causal relationship in that supply does create its own demand; and alternatively, the relationship between bed supply and utilization is spurious because it is dependent on antecedent variables which



influence both supply and demand (Harris, 1975). For example, if there was unmet need, then bed supply would increase to meet the deficit and utilization would naturally rise once new beds became operational. However, there are difficulties with this latter interpretation since what constitutes the optimum level and type of service provision that is required to satisfy medical needs and what is meant by 'unmet need' ?

Harris (1975) argued that if there was unmet need and demand for hospital care was initially high, then the relationship between bed supply and hospital utilization would disappear when this antecedent condition is taken into account. If in fact bed supply increases independently of need, then the relationship would persist even after controlling for demand. Harris tested these two views with data from 56 New York State counties for the period 1960-1970. He found that the relationship between increased bed supply and utilization was not spurious due to unmet need. Initial demand had no effect on bed supply.

As suggested by Roemer, it appeared that changes in physician decision-making and hospital policies in the face of differing levels of bed availability resulted in changes in admission patterns and length of hospital stay. Anderson (1973) similarly reported in his New Mexico study that changes in bed supply lead to significant changes in demand through both increased admission rates and lengths of hospital stay.

Roemer and Shain (1959) also observed that bed occupancy rates in the United States, were not highest in areas where bed supply per capita was lowest, rather the proportion of empty beds was approximately the same. That is, general hospitals maintained relatively constant occupancy rates irrespective of per capita bed availability. This outcome is similar for public, voluntary and private hospitals although each hospital type will have different incentives for maintaining occupancy rates.

Vacant beds reflect a hospital's emergency stand-by capacity, and daily fluctuations in the demand for inpatient care. However, empty beds over and above the hospital's emergency buffer may pose a serious threat to the hospital's financial position. Private sector hospitals must maintain high occupancy rates to produce an adequate flow of profits, thus ensuring their financial viability. Although the public and voluntary sectors are not directly driven by the same market forces, low occupancy rates are still indicative of under-utilization and wastage of resources, inefficiency and high overhead costs. Thus, to maintain existing stocks of resources and financial security, hospital administrators encourage a bed occupancy rate which is optimal for their institution to minimize costs and maximize organizational objectives.

The levels of utilization encouraged via administrative policies (in the order of 85-90% occupancy) may be independent of community need. In New Zealand in the 1970s and early 1980s, for example, supply induced demand was reinforced by the fact that the salaries of the medical superintendents and chief nurses of the public

hospitals were determined by the level of bed occupancy. If salary levels were to be maintained then high occupancy rates had also to be maintained. Although hospital behaviour is understandable from an organizational or institutional perspective, it does contribute to potential over-utilization, and to the perpetuation of the supply of expensive hospital resources. Even when need is not demonstrable, empty beds will be filled, thus maintaining occupancy rates.

As Roemer suggested and others have since collaborated, hospital bed supply impacts on utilization through medical practices. Attention now turns to the role of doctors as referral agents and gatekeepers to care.

#### **4.4 DOCTORS AS GATEKEEPERS TO HOSPITAL CARE**

The existence of Roemer's Law is indisputable but the mechanism through which supply creates its own demand requires further elaboration. Wennberg and Gittelsohn (1982, p100) suggest "the amount and cost of hospital treatment in a community have more to do with the number of physicians there, their medical specialties and the procedures they prefer than with the health of the residents". Doctors decide who is to be admitted and how long patients will be hospitalized.

Individual health services are organized and operate within the complex superstructure of the health care delivery system. The spatial and organizational arrangement of these health services, and the mechanisms by which patient flow is regulated between them,

impact upon individual service use. That is, patterns of health services utilization reflect infrastructural constraints of the health services system. Regulation of consumer demand, which is both diverse and potentially limitless, has become the responsibility of the medical profession, and in particular, primary care physicians.

Clearly, patients do not move freely between the community and the hospital sector. Access is controlled through domain specification and organizational interaction between the different health services. Primary care physicians mediate between patient needs and the provision of hospital resources and specialist services. They authorize patient entry into the hospital sector, a task over which they hold a virtual monopoly. General practitioners represent the patient's first point of contact with the health system. As such, they are the initial providers of care and arbiters of patient management. General practitioners, irrespective of practice setting, become the managers of patient care and the gatekeepers to secondary and specialist services (Somers, 1983; Hurley, 1986). Gatekeeping which occurs within the context of both doctor-patient encounters and professional interaction, becomes a tool for patient subjugation.

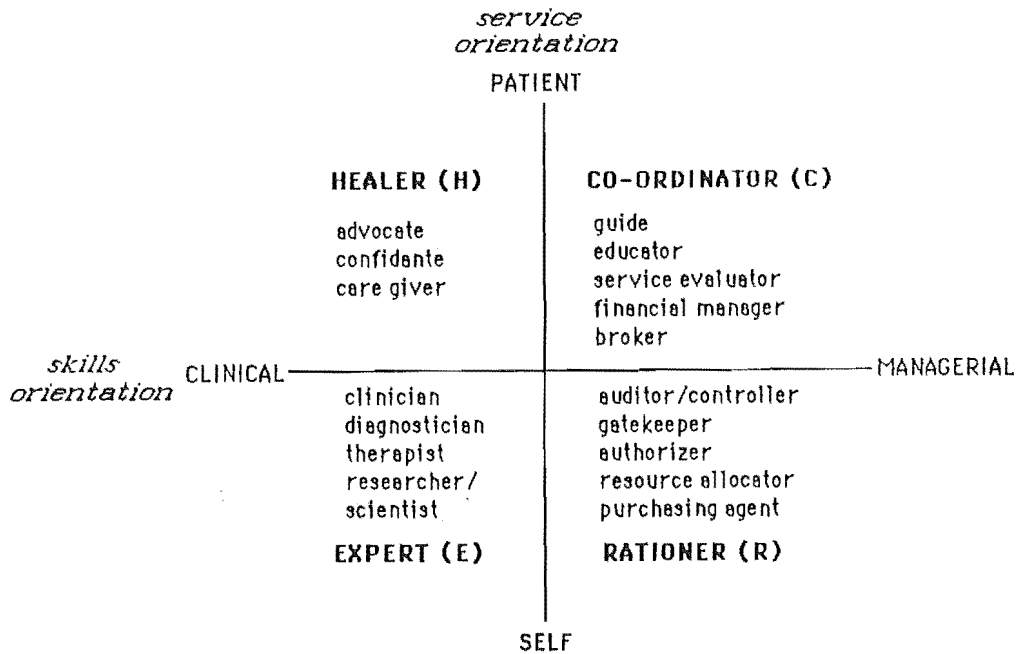
The tasks of the primary care doctor are well illustrated in the 1966 Millis Report on graduate medical education in the United States (a report that paved the way for family medicine to become a specialty in its own right): "When a patient needs hospitalization, the services of other medical specialists, or other medical or paramedical assistance, the primary care physician will see that the necessary

arrangements are made, giving such responsibility to others as is appropriate, and retaining his own continuing and comprehensive responsibility... The patient wants, and should have, someone of high competence and good judgement to take care of the total situation, someone who can serve as coordinator of all the medical resources that can help to solve his problem..." (quoted in Somers, 1983).

Management of patient cases involves planning, rationalizing, co-ordinating, and supervising the provision of care (Eskin, 1985; Vitalis, 1985). In the hope of improving their patients' health, doctors should draw on whatever resources are available and appropriate to the care of their patients. Their task as gatekeepers is to select patients they believe will benefit from resources available outside their own practices, and to oversee all the necessary referrals.

Hurley's model of doctor practice styles provides a framework to view the relative importance of case management functions in a physician's work tasks. A doctor has four basic roles as healer, coordinator, medical expert, and health care rationer (Figure 4.3). Each of these basic functions have to be performed to some degree, but individual doctors have different skills, abilities, and preferences which will influence their overall style of practice. The importance assigned to each function will reflect the doctor's preference for clinical or managerial tasks, and whether they are more patient or self oriented in his/her service goals. According to Hurley (1986), an increase in any of the roles will require a reduction in one or more of

the others. Thus, an increase in case management will occur at the expense of the healing and expert functions.



**Figure 4.3:** Case Management and Doctor Practice Styles  
(after Hurley, 1986).

#### 4.4.1 Professional Uncertainty

Wennberg et al (1982) believe variations in hospitalization rates reflect differing levels of professional uncertainty in the diagnosis and treatment of illness. If doctors are to behave as rational agents for their patients then they must: (1) know the effectiveness of various diagnostic measures and therapies in the identification and treatment of health problems; (2) know (diagnose) what particular consumers (patients) need and allocate technology and care based on

probable outcomes; (3) use information to maximize patient utility; and (4) manage their patients at the most efficient price by identifying the least cost methods for diagnosis and treatment (Wennberg et al, 1982). Identification of illness, determining patient prognoses for different treatment strategies, and choosing and implementing treatment, are all problematic. Doctors differ in their evaluation of patients and in their perception of the effectiveness of different therapies in meeting patient needs. Wennberg argues that the large differences in physician perception and judgement, reflect in variations in per capita use of health resources. The greater the degree of uncertainty doctors face in decision-making, the greater the number of admissions and the longer the bed stay.

Rates of hospitalization will vary when the risks and benefits of a medical procedure are not well established, and there is disagreement over its value, or when patient selectivity is not clearly defined. Cochrane (1972) has argued that many procedures are introduced into medical practice without adequate scrutiny, and without their effectiveness and efficiency being established on rigorous grounds. Diagnostic and therapeutic techniques are adopted or discarded on the basis of personal preference, peer group pressures, and coercion from the pharmaceutical industry and suppliers of medical equipment. In the absence of authoritative standards and general agreement on the value of medical procedures for individual patients, the style of medical practice and physician discretion takes precedence in determining utilization.

In studying variations in surgical procedures in 193 small areas of 6 New England States, Wennberg and Gittelsohn (1982) found little difference in predisposing, enabling or health status factors between the areas. They concluded "the large differences in surgical rates and the amount spent on hospital care must therefore be traced to factors that come into play after patients have contact with physicians... the crucial factor appears to be the system of medical care in this community" (1982, p101). They observed considerable variation in rates of tonsillectomy, hysterectomy and prostatectomy, all of which cause considerable controversy among physicians with respect to treatment. When the Vermont Medical Society, for example, decided that surgeons practising in areas with the highest rates of tonsillectomy were required to get a second opinion before surgery was performed, the probability of a child having his/her tonsils removed by age 20 years dropped from 60% to less than 10%.

Most hospitals have no authoritative body that closely evaluates the soundness of an admission nor the length of stay once the patient is admitted. Many hospital admissions are reported to be unnecessary, or preventable if there is adequate provision and use made of ambulatory services (e.g. Brown et al, 1985; Muslin and Appel, 1976). The most significant increases in hospitalization are expected to occur in areas where alternatives to general hospital care are perceived to be unavailable, inadequate or ineffectual, or poorly utilized (Anderson, 1973; Burt and Cooper, 1982). When hospital beds are readily available, a general practitioner may find it more expedient to admit a moderately ill person than to care for her/him on an ambulatory basis (Connell et al, 1984).



This interaction between health services is also evident in the philosophy of health maintenance organizations (HMO's). In contrast to maintaining or increasing rates of hospitalization, HMO's promote the use of less expensive primary ambulatory services with the specific intention of minimizing the need for more expensive hospital care. During the 1960's the Kaiser Permanente Medical Care scheme, an early HMO, maintained a bed supply of only 1.8 beds per 1000 subscribers - a level well below the national American average, but one which adequately met the needs of its subscribers. Although attracting a select clientele, Kaiser Permanente did successfully limit hospitalization by providing major incentives to doctors to diagnose and treat on an outpatient basis (Rogatz, 1974).

#### **4.4.2 The Referral System**

Service-environment relationships and inter-agency coordination are important features of health services utilization. The organizational structure of the health care delivery system aims to ensure that consumers, with their highly variable characteristics, are appropriately matched with the services they require. This should prevent any gaps occurring in their care, and at the same time, avoiding unnecessary duplication or overlap. The health care organization attempts to provide continuity of care, service coordination and ease of patient referral between its services. The health services system, as an organizational network, also encourages individual service accountability and responsibility for patient care. However, as is abundantly clear, such objectives are not successfully

achieved in current health care delivery systems. Health care is organizationally inaccessible to many people.

Interaction between health services occurs on an administrative or executive managerial level and on an operative level involving patient contact (Greenley and Kirk, 1976). Referral of patients is, in terms of this discussion, the most important form of exchange between health services. A referral can be regarded as a temporary, or permanent, transfer (including sharing) of care of a patient from one doctor or agency to another (London, and Stevens, 1980). Patient referral will be determined by the nature of the organizational interaction occurring between the services.

Patients are organizational resources. As such, they are needed in the legitimization of health service domains and objectives (Greenley and Kirk, 1986). Thus, referral of patients between services is more likely to occur if the outcome of exchange is beneficial to each agency in terms of their own values, expectations and organizational goals (Strantz and Miller, 1966). The 'ping-ponging' of patients among Medicaid doctors is an example of this. When patients are not viewed as valuable resources, that is, cooperation would threaten organizational autonomy, patient access will be strictly limited. 'Patient-dumping' in the USA occurs because hospitals refuse to accept patients who place too many demands on their services for little or no monetary return and who are seen to diminish the hospital's image and prestige. ✕

Although the referral of patients between health services occurs within the context of central government policies on health and is governed by different statutes and regulations, referrals are usually regarded as voluntary and cooperative transfers between health agencies (Greenley and Kirk, 1986). However, different services possess different resource and power bases, and are therefore able to manipulate the referral process to best suit their own ends. This differentiation in bargaining power is particularly noticeable at the level of the organizational boundary between the primary care and hospital sectors, but is also evident between services operating within the same health sector.

Patient access to health care is hindered by professional conflicts and lack of communication between services. Health services operate as a series of interdependent yet separate organizations. Many resist sharing of patient care through the fear that increased organizational dependency will decrease their service autonomy. Doctors have, for example, traditionally expressed the right to choose their own style of medical practice (within the broad limits of the profession), and react strongly against actions that are seen to infringe on their autonomy in decision-making. According to Greenley and Kirk (1986) the chance of referral increases with greater understanding of and agreement over service activities and target populations.

The referral process involves two key decisions: is a referral needed? and if so, where should the patient be referred? Doctors tend to assess the need for referral in terms of the clinical and/or

social problems incurred in patient care. Referral to a hospital outpatient department may be prompted by the need for: (1) specialized treatment or advice on a management plan following the initial diagnosis in primary care; (2) second opinions from consultants when professional uncertainty occurs in continuing diagnosis or treatment; (3) biochemical and diagnostic investigations not available in general practice; (4) as a matter of necessary patient review by specialist medical staff; and/or (5) to satisfy patient demands for specialist services (Berkhout, 1984). Admission to hospital occurs for similar reasons although precipitating events tend to be much more serious and urgent. The need for intensive nursing care is also a prime factor in hospitalization.

Patient access to hospital care is regulated through the referral system. Entry into the hospital sector occurs directly from primary care, or indirectly via specialist outpatient services whence consultants transfer care to an inpatient basis. A direct referral into hospital implies the general practitioner has opted to bypass the consultant who regulates patient flow from within the hospital sector and has laid claim to more intensive and expensive hospital inpatient care on the basis of his/her own diagnosis (Berkhout, 1984).

Use of hospital in- and outpatient services is dependent on the actions of the professional gatekeepers. General practitioners working in primary care, together with the secondary care specialists, assess and authorize patient needs. As relatively independent contractors of care, doctors can exercise a broad range of discretionary powers over the referral process. The attractiveness

of a hospital to a referring doctor will depend on the ease of admission, range and quality of services offered, quality of patient care, and physical accessibility. The ease with which a doctor can get his/her patients admitted will reflect the hospital's stock of empty beds and managerial policies concerning rights of admission. An important institutional factor affecting patient flow into the hospital is the waiting list. Waiting lists are manipulated, largely by medical consultants, for the purposes of assigning admission priority, for regulating 'excessive' demand, and increasingly as a way of diverting people into the more lucrative private sector market. X

There are wide discrepancies in the referral of patients to health services, as evidenced in the earlier discussion on small area variations in rates of hospitalization. Referral patterns vary by medical specialty, between doctors, between local communities, and over time. The decisions whether and where to refer are clearly influenced by patient needs, but other factors enter the decision-making process. In recent years, health care systems have been criticized for promoting the needs of the providers and funders of care over and above those of the users (Wistow, 1982; Health Benefits Review, 1986).

Decisions made by doctors on patient care are discussed widely in the medical literature, but never in a broad synthesis (Berkhout, 1984). As a result, the implications of the referral process in terms of patient access to care have largely been overlooked.

## **4.5 SUMMARY: DETERMINATION OF HOSPITAL UTILIZATION**

Variations in rates of hospitalization reflect a multitude of factors that are intrinsic to the need for and supply of health care. The health care delivery system dominates individual utilization behaviour by controlling access in three ways: (1) through the supply of health care resources that are available for use; (2) through the organization of health care; and (3) via the beliefs that underpin the provision and utilization of health services.

Clearly, if resources are not provided, they cannot be used - but as Roemer suggested, hospital beds built tend to be beds used. Regional variations in levels of service provision reflect in regional variations in rates of utilization. Communities with high per capita supplies of hospital beds typically have high rates of hospital utilization. Neighbouring areas with similar health needs and community characteristics can have vastly different levels of hospitalization.

Because the laws of supply and demand do not operate in the health sector as they do in an open market, the supply of health care resources is able to create its own pattern of demand. The allocation and management of resources influence patterns of demand, even when unmet need is not demonstrable. Although Roemer's Law applies to the hospital sector, the same phenomenon of supply induced demand also exists in the primary care sector. Although some of the variation in utilization patterns stems from professional

uncertainty in diagnosis and treatment, the medical profession, individually and collectively, re-assess the concept of patient need for hospitalization in line with the availability of health care resources. Different bed supplies, and differential subsidies inside and outside hospitals, affect doctor behaviour in both the admission of patients and duration of hospital stay. Health services manipulate utilization in the pursuit of their organizational goals.

The primary function of the health system's organizational structure is to integrate different health services for mutual benefit. Organizational factors impact on utilization because it is the spatial and operative organization of the health system that provides the means by which people gain access to care. Consumer pathways to housing are well documented. Similarly, it is the organizational links between health services that define patient pathways to care. As Berkhout states "referral patterns 'grow into' the space of health care infrastructure" (1984, p33).

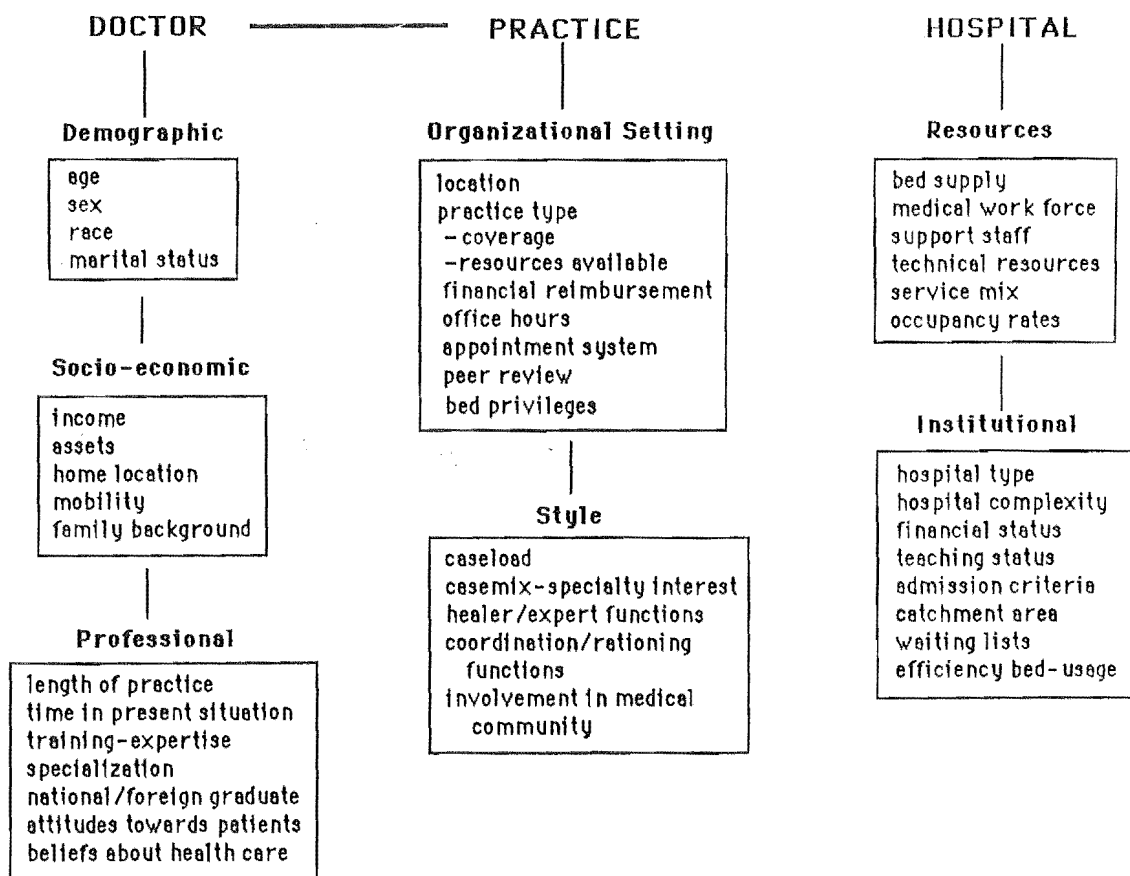
Referral patterns are the outcome of doctor gatekeeping to resources and health service interaction. Medical practitioners are not simple translators of people's health needs into demand. Doctors are the managers of ill-health and diswelfare. They mediate between patient needs and the provision of resources. Patient access to care depends on medical authorization, but doctors exercise major discretion (within broad structural limits) over patient care decisions. Because patients are seen as important organizational resources and a key element of interagency exchange, it is not

surprising that referral decisions are influenced by service-oriented goals and the economics of health care.

Beliefs about health care strongly influence the allocation and organization of health care resources. In Chapter Two it was argued that the meaning and perception of health, and the nature of the medical system, reflect the nature of social formation under capitalism. Ideological forces are expressed in local contingencies. The social functions of medicine are, for example, manifested in daily medical practice and decision-making. The provision of resources and the structure of the system mirror the commodification of health needs and the institutionalization of medicine. Health care beliefs are expressed in medical ethics, codes of conduct, medical expertise (knowledge and technical proficiency), medical education and training, specialization and division of the medical work-force. These factors are all indicative of the basic philosophy of the health care delivery system.

Hospital utilization can be regarded in more specific terms as a function of three groups of system variables as eluded to throughout this chapter; (1) physician characteristics; (2) practice style and setting; and (3) hospital or institutional characteristics (Rosenblatt and Moscovice, 1984; Berkhout, 1984). Figure 4.4 summarizes these variables. Different but overlapping sets of system factors will become important at different levels of analysis and in different empirical situations (Berkhout, 1984). Per capita bed supply may, for example, be more important in explaining regional variations in hospitalization rates, whereas physician characteristics that influence





**Figure 4.4:** Health Service and Organizational Determinants of Hospital Utilization.

patient referral may provide greater insight into patterns of hospital utilization at the local level.

Patterns of health services utilization have traditionally been explained in terms of individual determinants. These include the psychological, motivational and social group influences that govern individual behaviour, or more generally, predisposing, enabling and illness factors. Although giving some recognition to organizational constraints on accessibility, behavioural models assigned primacy to the individual and family unit. In seeking to understand patterns of health services utilization it is essential to consider variations in health needs and the legitimate role of individual determinants. However, the behavioural approach fails to take into account the very real effect that the health services system has on conditioning individual action.

The model proposed in this thesis calls for increased appreciation of the importance of system factors in determining patterns of health services utilization. This view is founded on the basic argument that individual behaviour in seeking and using health care resources is regulated and directed by the medical profession, who acting in the interests of capital, manage a highly functional health care system - a view not dissimilar from Pahl's reformulated model of urban managerialism. This will now be explored with reference to the disorder of *Diabetes Mellitus*.

## CHAPTER FIVE

### A NEED FOR HEALTH CARE: THE HEALTH CONSEQUENCES OF DIABETES MELLITUS

#### 5.1 INTRODUCTION

*Diabetes Mellitus* is a chronic disorder which through its complications, results in reduced life expectancy, increased morbidity and frequent hospitalization of those persons affected. Diabetes is, however, underestimated as a public health problem. In New Zealand, as in most Western countries, diabetes has a low public and political profile despite the substantial health, social and economic costs incurred with the disorder.

Diabetes affects a significant proportion of New Zealand's population. The health consequences of the disorder are severe. Acute diabetic problems and long term complications result in increased illness, decreased quality of life, and shortened life-span. Diabetic persons are major consumers of health care resources in both the primary but especially the expensive secondary care sector. The social and economic impacts of the disorder extend beyond the individual to the family unit and the community at large.

If the basic aim of improving health outcomes is to be realized, then health care facilities need to be organized in a fashion

most appropriate to the needs of the target population. The degree to which health services and intervention strategies are successful in controlling or curing health problems depends foremost on the degree to which they understand and accommodate the basic character of the disorder involved.

The aim of this chapter is to investigate the medical and epidemiological characteristics of diabetes. Three dimensions will be discussed: (1) diabetes pathogenesis and physiology; (2) its occurrence and aetiology; and (3) impacts on physical health status. Together these identify the basic health needs underlying the provision of diabetes care which is the focus of Chapter Six. Both chapters exemplify the arguments forwarded in the preceding conceptual chapters.

**Choice of Case Study:** Diabetes is a good case study for several reasons. It is an example of one of the chronic disorders that comprise the modern disease burden in Western societies. It affects over 100,000 people in New Zealand alone (Neal and Beaven, 1988), its health consequences are severe, and the disorder necessitates life long treatment. Those affected persons must, therefore, maintain on-going contact with the formal health care delivery system. Thus, individuals are subject to manipulation by the medical bureaucracy.

The traditional managerial interests of organized medicine are clearly evident in diabetes care, and these are well served by current delivery structures for care. As Chapter Six will show, there are two major treatment themes in diabetes care: clinical care and patient education. Even though clinical care dominates service

provision, both treatment philosophies serve the medical model to a greater or lesser extent.

The nature of the treatment of diabetes has, however, changed through a growing understanding of diabetes as a health problem. It will be seen that the aetiologic and pathogenic nature of diabetes (discussed below) demands a health care approach founded on a true understanding of the determinants of health. Diabetes control is the outcome of complex processes involving metabolic and pharmacological factors and psycho-social behaviour. The cornerstone of both diabetes causation and treatment is lifestyle. The introduction of patient education into diabetes care attests to a broadening of the understanding of diabetes, to the expansion of medical interests in daily life, and to the co-optation of lifestyle politics into modern health care.

## **5.2 WHAT IS DIABETES?**

By definition diabetes is a medical problem. It covers a spectrum of conditions, all of which are characterized by *hyperglycaemia* (elevated levels of blood glucose) (Fajans, 1982). Although popularly associated with abnormalities in carbohydrate metabolism, the body's inability to handle starches and sugars, diabetes is also characterized by disorders in fat and protein metabolism. Diabetes is associated with metabolic changes at the cellular level and with defects in the vascular and neural systems (Rodriquez, 1982). Some 2000 years ago, the Roman physician Areteaus described diabetes in the following fashion:

Diabetes is a wonderful affection... being a melting down of the flesh and limbs into urine... the patients never stop making water; but the flow is incessant as if from the opening of aqueducts. The patient is short lived... for the melting down is rapid, the death speedy (Department of Health, 1980, p10).

Diabetes results from an absolute or relative deficiency of the hormone *insulin*. Insulin permits the uptake of glucose from the bloodstream and facilitates its transport through cell membranes. Glucose is the body's immediate and predominate source of fuel. Without insulin, glucose is locked into the bloodstream and cannot be used effectively as the body's energy source. Cells become 'starved of energy in the midst of plenty'.

There is a catabolic tendency towards the breakdown of stored glycogen, body fats and proteins. This mobilization of stored energy reserves in addition to exacerbating hyperglycaemia, leads to elevated blood concentrations of free fatty acids, triglycerides and ketones. If left untreated, the pathway to ketoacidosis is initiated and this leads to coma and death (See Appendix A.1 for a more detailed discussion of diabetes pathogenesis and physiology).

Diabetes is usually diagnosed when patients present with symptoms (summarized in Appendix A.2). A diagnosis of diabetes is technically established through arbitrarily set diagnostic criteria based on the elevation of blood glucose concentrations, that is, on the demonstration of hyperglycaemia (international standards for diagnostic confirmation are listed in Appendix A.3). The

determination of a single blood glucose measurement in excess of the diagnostic criteria is in most cases sufficient to establish the diagnosis particularly when the patient also exhibits symptoms. As the WHO Study Group on Diabetes state "The clinician must always feel confident that the diagnosis of diabetes is fully established since the consequences for the patient are considerable and lifelong" (1985, p10).

In New Zealand, as in most Western countries, there are two predominate classified types of diabetes: (1) Insulin-Dependent Diabetes Mellitus (IDDM); and (2) Non Insulin-Dependent Diabetes Mellitus (NIDDM) which has two subclasses, obese and non-obese (WHO Study Group on Diabetes, 1985). Distinguishing between the two is important because IDDM and NIDDM have different pathogenic mechanisms, qualitatively and quantitatively different biochemical characteristics, severity of symptoms and health outcomes. Of particular relevance to this discussion is the fact that these two types of diabetes are perceived and treated quite differently by patients, health professionals and the public at large. As a consequence, they have placed different demands on the health care system.

The basic feature which separates IDDM and NIDDM is the patient's reliance on injected insulin for survival. In developed countries, IDDM affects about 10-20% of all diabetic persons. Without injected insulin, IDDM patients would die. The pathogenesis of IDDM centres on the selective immunological destruction of the insulin producing pancreatic B-cells (Gepts, 1982). The diminution of B-cell functioning means the endogenous production of insulin is insufficient to satisfy metabolic needs. Clinical onset of IDDM can be

rapid. Glucose and ketone levels in the blood and urine rise sharply and the patient develops severe ketosis and acidosis. The development of this form of diabetes has traditionally been associated with children and adolescents. However, as suggested by the data presented in Chapter Nine, this is a misconception. IDDM occurs at all ages.

Keen (1982) states that individuals with NIDDM are all those people who meet the diagnostic criteria of diabetes mellitus but who are able to survive without injected insulin. The majority of NIDDM patients, who are usually obese, may not suffer from a total deficiency of endogenous insulin (as for IDDM). Rather, they have insulin resistance (relative deficiency) which when superimposed on B-cell losses of variable degrees gives rise to high blood glucose levels. Resistance may reflect defects in the binding of insulin to receptors on cell walls, post-receptor intracellular defects, or a combination of both (Fajans, 1982). Catabolic processes are not so prominent in persons with NIDDM since insulin action, although increasingly reduced, is still present. NIDDM patients therefore tend to have a slow onset over years and are usually free of symptoms (Levine, 1982).

Onset of NIDDM occurs predominantly in middle and old age. Individuals with NIDDM may have had impaired glucose tolerance and elevated blood glucose levels, and have been asymptomatic, for many years before the diagnosis of diabetes was established. NIDDM patients may even present with established chronic complications of hyperglycaemia at the time of diagnosis of diabetes because of symptom free raised blood glucose levels over many years.



### 5.3 HOW MANY PEOPLE ARE AFFECTED?

Diabetes is underestimated as a health problem. It is difficult to obtain accurate data on its occurrence and distribution. Epidemiological research on diabetes has been plagued by the use of different diagnostic criteria, a lack of standardization in screening procedures, variations in the timing of studies, use of different study scales and populations (West, 1978). However, it is clear that diabetes affects a significant number of people, and that the attack rate is increasing in many parts of the world.

Observations throughout the world indicate that NIDDM is much more prevalent than IDDM. In the developed world, Caucasian population-based prevalence estimates of NIDDM are in the order of 2-6%, a range in which New Zealand falls. NIDDM is approximately 5 to 10 times as common as IDDM in these populations. In developing countries of Africa, Asia, and Central and South America, IDDM is very rare but 1-2% of the population is affected by NIDDM (Mngola, 1982). IDDM is also rare in ethnic groups like the Polynesian, Melanesian and Micronesian communities of the Pacific, in American Indians, Eskimos, Chinese and Japanese living in their own environments (Zimmet and King, 1985).

Several studies reveal the extent of diabetes in New Zealand's population (Table 5.1). **Prevalence** is a cross-sectional parameter enumerating cases in a population at a given point in time, and **incidence** is a longitudinal parameter measuring the number of new cases diagnosed in a population over a given period of time. With the

**TABLE 5.1**  
**DIABETES IN NEW ZEALAND**

<b>Reference</b>	<b>Rate</b>	<b>Study Group</b>
<i>Prevalence</i>	<i>Percent</i>	
1966 Prior and Davidson	2.8	Caucasian, age $\geq 20$ years, Carterton
	8.1	NZ Maoris, age $\geq 20$ years, Central/ East North Island
1969 Murray et al	4.0	Caucasian, adult, Rangiora
	1.65	Previously diagnosed diabetes
	2.3	Newly detected
1981 Prior and Tasman-Jones	14.1	NZ Maoris, Males, age $\geq 25$ years
	18.4	NZ Maoris, Females, age $\geq 25$ years
	4.6	NZ Tokelauans, Males, age $\geq 25$ years
	10.9	NZ Tokelauans, Female, age $\geq 25$ years
1984 Brown et al	3.1	Working population, age 15-65 years, Christchurch
	1.55	Previously diagnosed diabetes
	1.55	Newly detected
1987 Mason et al	0.11	Caucasian, age 0-19 years, Canterbury
<i>Incidence</i>	<i>Per 100,000</i>	
1980 Crossley and Upsdell	10.4	Age 0-19 years, New Zealand
1987 Mason et al	11.7	Caucasian, age 0-19 years, Canterbury

passage of time, the Rangiora figure of 4% (Murray et al, 1969) has been taken as the national prevalence of diabetes in adult European New Zealanders. The disparity with Prior's earlier results reflects differences in detection rates due to differences in the study populations but more importantly in the screening methods used. The Rangiora survey findings were supported by the more recent study of a working population aged 15-65 years in the nearby city of Christchurch (Brown et al, 1984). In total 3.3% of this work-force had diabetes. Half of all those with diabetes had been diagnosed previous to the study, thus giving a rate of known diabetes of 1.55%.

The occurrence of diabetes in New Zealand's Maori and Pacific Island populations has risen dramatically in the last 20 years, particularly in females and the elderly. More recent studies involving ethnic minorities in New Zealand confirm Prior's earlier work that the rate of diabetes in Polynesian populations greatly exceed those for Caucasian New Zealanders. Polynesian populations are predominantly affected by NIDDM, and again about half of all cases only are diagnosed.

The increased prevalence of NIDDM in New Zealand's Polynesian population is well documented. Although no epidemiological data are available, informal observation of the number of patients being treated in general practice, attendance on hospital inpatient and outpatient services, together with community screening programmes, suggest that the number of people with NIDDM in New Zealand's Caucasian population has also risen.

There are major methodological problems in determining the extent of IDDM in the community. Problems arise from difficulties in both classification and enumeration. Because there are inherent conceptual problems with the pathogenic understanding and definition of the disorder, it is difficult to distinguish whether some adult cases have IDDM (autoimmune B-cell destruction), or have NIDDM but are treated with injections of exogenous insulin. Most research on IDDM has concentrated upon persons under 20 years of age because it is assumed that all youth-onset diabetes is true IDDM.

In terms of the development of IDDM in youth, New Zealand is classified as a medium risk environment. With an annual incidence rate in persons aged less than 20 years of 11.7 per 100,000 (Mason et al, 1987) New Zealand ranks alongside countries like England, Scotland, Canada and the United States (Bloom et al, 1975; Patterson et al, 1983; Ehrlich et al, 1982; Tajima et al, 1985). Since IDDM patients usually present with the development of severe symptoms over a relatively short time span of usually a few weeks or months, the detection of IDDM in youth populations is virtually 100%. As Table 5.1 shows diabetes affects one in every thousand New Zealand children.

Enumerating prevalence of IDDM is problematic even in this younger age group. There are difficulties in ensuring complete case ascertainment and relatively large population based studies are required if reliable data are to be obtained. In the last five years as a means of overcoming definitional and practical problems in identifying IDDM, attention within diabetes epidemiology has focussed on Insulin-Treated Diabetes Mellitus (ITDM). This is an

unofficial, but recognized, categorization of diabetes which includes all diabetic persons who are treated with exogenous insulin.

The ITDM population will include all persons with IDDM and that (small) proportion of NIDDM patients who for whatever reason are treated with insulin. Because this sub-population forms the basis of the epidemiological and health services research presented in Chapters Nine to Eleven, ITDM will not be discussed in detail here, albeit that the occurrence of insulin-treated diabetes in several Western countries, including New Zealand, has been documented at around 3.5 per 1000 persons (Green, 1985; Hedley, 1982; King, 1987; Brown and Scott, 1988).

## **5.4 DIABETES AETIOLOGY**

Striking geographical and ethnic differences in the occurrence of diabetes are revealed by cross-cultural comparisons of epidemiological data. Various studies on diabetes epidemiology in Pacific Island communities have shown:

- (1) Prevalence of NIDDM increases with modernization and westernization of the lifestyles of populations *in situ*;
- (2) Polynesians living traditionally in rural environments have lower prevalence rates of diabetes than urbanized communities of the same ethnic origin;
- (3) Prevalence increases in migrants following migration from traditional rural to urban environments; and
- (4) Certain ethnic groups have higher rates of diabetes compared to other races living in the same

environment. Urbanized Polynesians, Micronesians and Australian Aborigines have prevalence rates 2 to 4 times those of Caucasians (Prior and Davidson, 1965; Prior et al, 1978; Zimmet and King, 1982; Zimmet and King, 1985).

Such geographic observations support the orthodox thesis that diabetes results from a complex interaction between a spectrum of social and physical environmental risk factors and a genetic predisposition towards the development of the disorder. That is, genetic susceptibility to diabetes is unmasked by various acquired environmental factors appropriate to IDDM and/or NIDDM. Variance in genetic susceptibility, importance of environmental diabetogenic factors, and genetic environmental interactions produce different prevalence and incidence rates in different populations. The risk of children and adolescents developing IDDM, for example, varies 35 fold between Japan which has the lowest incidence rate (children 0-17 years 0.8 per 100,000) and the Scandinavian countries with the highest rates (La Porte et al, 1985).

The emergence of diabetes as an international health problem is best interpreted under Powles' thesis of **biological maladaptation** (Powles, 1973) and the model of health determination presented in Chapter Two. Diabetes has arisen as a result of the profound social changes secondary to the industrial revolution (e.g. urbanization, acculturation and commodification of life). Within the time frame afforded by industrial and post-industrial modernization of society, the body has not been able to adjust biologically to: (1) an abundant food supply that is rich in sucrose, refined carbohydrates, fat and

alcohol; (2) changes in work habits and reduced levels of physical exertion; (3) alterations in physical habitat; and (4) emotional and mental stresses associated with modern lifestyles. Processes of social transformation have been super-imposed on a relatively 'time-dependent' racial biological inheritance.

Data from third world and developing countries, such as that summarized above, best illustrate this explanation. In many of these countries, economic transition and concomitant social and environmental change have been much more rapid and much more recent than in the Western world. Development has been condensed into a very short time span of only a few decades. It is during the last 20 years that diabetes and other chronic disorders have emerged as major health concerns in these areas.

In many of the Pacific Polynesian, Melanesian and Micronesian Islands, rates of change from subsistence to cash economies, modernization and westernization are dramatic and unprecedented. For example, the Micronesian Pacific Island of Nauru gained, from the development of its phosphate reserves, one of the highest per capita incomes in the world. The Islanders readily adopted an 'Americanized' lifestyle especially in food habits and decreased physical activity. Diabetes prevalence rose dramatically and is now comparable to that of the American Pima Indian, the population noted as having the highest prevalence of diabetes in the world (Zimmet et al, 1978). NIDDM affects 30 of every 100 adult Nauruans and exceeds 70% in those aged 60 or more years (Zimmet et al, 1978).

The Pacific Island migrant studies also illustrate the impact of lifestyle change on levels of health. For example, the age standardized prevalence of diabetes in migrants (aged 20 years and above) to New Zealand from the isolated atolls of Tokelau was 10.8% in females and 4.4% in males in 1975-77 (Stanhope and Prior, 1980). This compared to 1968-71 pre-migration rates in Tokelau of 6.1% in females and 2.3% in males. Traditional-living Wallis Islanders similarly are reported to have lower rates of diabetes than the migrant population now living in urban New Caledonia (Zimmet and King, 1982).

Identifying the impact of various social and environmental changes on the occurrence of diabetes is problematic since it is difficult to ascertain which factors or combination of factors are operative and because many environmental changes occur simultaneously with modernization (Zimmet, 1978). The same processes probably operate in both the developed and developing world, but the impact on health is more pronounced in the latter because social and economic change is occurring much more rapidly. In comparison, the rise of diabetes as a public health problem in the Western world has been more gradual and has occurred over a much longer period of time. The emergence of the disorder parallels a two hundred year post-industrial history of economic development and social change.

A number of specific factors have been suggested as acquired or environmental risk factors to the development of diabetes. The four main contenders for NIDDM are obesity, dietary factors, physical inactivity and stress (See Appendix A.4 for further explanation).



These four variables are all 'lifestyle factors'. Additionally, a number of drugs that are in common medical use, diuretics and steroid medications for example, appear to be diabetogenic, and some environmental toxins have also been implicated in the manifestation of diabetes.

Empirical evidence also indicates that certain families and racial groups are at greater risk to the development of diabetes than others. The dominant view to date is that IDDM is caused by the inheritance of disease-susceptibility genes which 'permit' autoimmune attack on insulin producing pancreatic B-cells (similar to organ rejection processes). The upsurge of scientific interest in genetic engineering in recent years, has seen diabetes research concentrating more and more on the role of genetics in diabetes aetiology. However, since the concordance rate between identical twins where at least one twin has IDDM, is less than 50% (c.f. 100%), genetic susceptibility cannot be the only aetiological factor involved in IDDM (Barnett et al, 1981). Environmental factors, autoimmunity and viral infections have all been included in the processes resulting in the diminution of B-cell functioning - the pathogenic cause of IDDM. A simplistic but often stated approach to the aetiology of IDDM is that viral infections initiate the autoimmune destructive attack on the pancreatic B-cells in individuals genetically susceptible to diabetes (See Appendix A.4 for further discussion). There is no evidence yet to suggest that viral infections and immunological factors are important in the causation of NIDDM.

Even though genetic research tends to involve very selective studies in IDDM, familial histories are more common in NIDDM. The

rate of discordance in pairs of identical twins where at least one twin has NIDDM, has been reported at only 9% (Barnett et al, 1981). However, little research is directed at NIDDM and no genetic markers have as yet been isolated.

Empirical data similarly indicates the existence of yet undefined genotypes which make certain populations particularly susceptible to NIDDM, like the Pima Indians, Nauruans, Pacific Island populations or New Zealand's Maoris. The occurrence of diabetes in some of these groups appears to be reduced with the admixture of Caucasian genes (Zimmet and King, 1985). Diabetes most probably reflects the inheritance of certain biological characteristics, but like many of the environmental risk factors, the exact role played by genetic susceptibility is unclear.

The significance of inter- and intra-population differences has been eroded by changes in population characteristics, economic structures and patterns of lifestyles. Diabetes was originally conceptualized, both at individual and national scales, as a disease of the affluent. In the 19th century, diabetes was like gout, an affliction of 'nobility'. However, the relationship of social class to diabetes is now uncertain (the few available studies present conflicting results) (West, 1978; comment, *The Lancet*, 1982). Rises in standards of living overall has meant all individuals are at increased risk to the disorder. In the United States, there is evidence to suggest that the prevalence and incidence of NIDDM is now higher in low income families. The relationship between socio-economic status and diabetes most probably reflects the strong inverse relationship that exists between obesity (and other lifestyle factors) and family income

(comment, The Lancet, 1982). Such interactions may very well exist in New Zealand, especially with respect to its ethnic minorities.

There are still marked variations in the prevalence of NIDDM and IDDM between countries with different levels of economic wealth. However, all societies, irrespective of their stage of socio-economic development are experiencing, to some degree, the adverse health consequences of global economic development (West, 1978; Grabauskas and Tuomilehto 1982). Diabetes is now evident in most countries.

Empirical evidence strongly points to the biological maladaptation of people to current lifestyles with a complex interaction occurring between genetic and acquired environmental factors. However, the importance of biological factors, the role of social and physical environmental risk factors, and the how external factors unmask genetic susceptibility in predisposed individuals to the development of diabetes remain unclear.

## **5.5 WHAT IMPACT DOES DIABETES HAVE ON PHYSICAL HEALTH STATUS ?**

The impact of diabetes on health is not appreciated by the public nor the State. Comprehensive reviews of diabetes complications can be found in such texts as the *Diabetes Annual* (various years) or *World Book of Diabetes in Practice* Vol. 2, 1986. This section simply aims to highlight the extent of diabetes related morbidity and mortality, thereby giving an appreciation of the nature and scope of diabetes health problems. Although this discussion

concentrates on physical health status, the costs of diabetes extend well beyond physical impairment. The disorder has major psychological and economic repercussions for the patient, the supporting family unit and society at large.

### **5.5.1 Morbidity**

As Table 5.2 illustrates, the health consequences of diabetes are many and varied. These impact severely on patients' quality and duration of life. Diabetes health problems break down essentially into either the acute short-term or chronic long-term complications of diabetes.

#### **1. Acute Health Problems:**

Hyperglycaemia is the hallmark of diabetes (Section 5.2). Relief of symptoms and control of hyperglycaemia is the primary goal of diabetes care.

Diabetes ketoacidosis involves major catabolic events and risks to the patient (see Appendix A.1). More than half of all diabetic ketoacidotic episodes are precipitated by infection and increased but unmet insulin demand. An infection need not be very severe to initiate major metabolic stress in diabetes (Bibergeil and Felsing, 1986). A relatively benign infection such as a sore throat can lead, through increased metabolic rate and greater insulin demand, to relative insulin deficiency with resultant hyperglycaemia and ketoacidosis.

**TABLE 5.2**  
**HEALTH CONSEQUENCES OF DIABETES**

Acute Metabolic Problems	Chronic Complications
Hyperglycaemia Ketoacidosis Hypoglycaemia Infection Complications of Pregnancy	<ol style="list-style-type: none"> <li>1. Macrovascular Complications               <ul style="list-style-type: none"> <li>* heart disease</li> <li>* cerebrovascular disease</li> <li>* peripheral vascular disease</li> </ul> </li> <li>2. Microvascular Complications               <ul style="list-style-type: none"> <li>* retinopathy (and other eye disease)</li> <li>* nephropathy</li> </ul> </li> <li>3. Neuropathy               <ul style="list-style-type: none"> <li>* peripheral</li> <li>* autonomic</li> </ul> </li> </ol>

Hypoglycaemia (abnormally low concentrations of blood glucose) is perhaps the commonest acute transient complication of diabetes. Almost all IDDM patients experience mild hypoglycaemic reactions, and varying proportions will experience extreme events requiring hospitalization (Yeo, 1986). Hypoglycaemia is a serious day-to-day diabetes management problem. An excessively low blood glucose level stimulates the release of adrenalin and impairs the central nervous system - the brain uses glucose as its sole source of fuel and a continuous and steady supply of glucose is required for normal cerebral functioning (Kaneko, 1982; Yeo, 1986). The resulting symptoms are listed in Appendix A.5. Hypoglycaemic reactions are serious because many patients incur accidental injury during even mild hypoglycaemic episodes. Extremely low blood glucose concentrations can cause convulsion, sudden loss of consciousness, and even death.

## **2. Chronic Complications of Diabetes:**

The development of severe chronic complications is the outcome of prolonged hyperglycaemia. As Table 5.2 indicates, these fall into two main categories: (1) vascular disorders involving macroangiopathy and microangiopathy; and (2) neuropathic problems.

Diabetes has the potential to affect the entire arterial system. It is associated with accelerated atherosclerotic damage to the larger blood vessels of the heart, brain and lower extremities (Serrano Rios, 1982). In developed countries, coronary heart disease and its consequences like myocardial infarction are universally more

frequent (three fold increase in risk) and more severe in diabetic than non-diabetic persons (WHO Study Group on Diabetes, 1985). Although occurring earlier and more extensively, macrovascular disease is qualitatively similar in character in diabetic and non-diabetic populations. Risk factors operating among the population at large also operate in the diabetic population (WHO's Multinational Study on Vascular Disease, 1985). Hyperglycaemia, duration of diabetes, abnormal lipid profiles, hypertension, smoking, obesity, and age all increase the risk of macrovascular disease (Janka et al, 1985; WHO Multinational Study of Vascular Disease, 1985). The interaction of multiple risk factors may simply accelerate the atherogenic process.

One of the major health cost of diabetes is peripheral vascular damage to the lower limb extremities (Table 5.3). Such damage frequently results in operations to excise pieces of the lower limbs, including amputation. Beaven (unpublished studies) conservatively estimates the cost to New Zealand of providing medical treatment for diabetic amputation to be no less than \$5 million dollars per annum. Diabetic neuropathies and microvascular disease predispose patients to foot injury and lower limb calamities. Relatively minor events become major health problems. For example, if a skin abrasion, laceration, or minor burn goes unfelt and undetected, this minor injury may soon become infected. The resultant infection worsens an already impeded (through atherosclerosis) blood supply to the lower limb. Skin and tissue breakdown, and the damage may lead to ulceration, sepsis and gangrene. Amputation of the toes, foot or the lower limb may become inevitable (Lippman, 1979).

**TABLE 5.3**  
**SELECTED HEALTH COSTS OF DIABETES**

---

1. Peripheral Vascular Disease (PVD)

- \* 4 fold increase in PVD in diabetic men and five fold in women.
- \* Lower limb amputations are 10-20 times more common in diabetic individuals.
- \* Over 50% of all (non-traumatic) lower limb amputations in the United States occur in diabetic patients.

2. Diabetic Eye Disease

- \* Diabetes is the leading cause of new blindness in adults.
- \* Americans with diabetes are 25 times more prone to legal blindness and visual handicap than the non-diabetic person.
- \* At least one of every ten individuals with NIDDM is expected to develop some form of visual handicap or blindness.
- \* Between one-third and 60% of IDDM patients have severe visual handicap or blindness after 20 years duration of diabetes.

3. Renal Disease

- \* Diabetic nephropathy occurs in up to 45% of IDDM patients with risk of renal failure increasing with the duration of diabetes.
  - \* Rate of survival after the onset of proteinuria is very poor. Nearly 50% of IDDM patients die within seven years after the onset of proteinuria.
- 

*(References: Deckert et al, 1978; Palmerb et al, 1981; Deckert and Parving, 1982; Christiansen et al, 1985; Palumbo and Melton, 1985; The Carter Centre of Emory University, 1985; WHO Diabetes Study Group, 1985; Panzram, 1987; Neal and Beaven, 1988).*



The microangiopathic thickening of capillary basement membranes in the retina and kidneys, due to high blood sugars over the years, forms a second group of vascular complications of diabetes. The consequences of diabetic eye and kidney diseases are severe (Table 5.3). Most diabetic persons, and practically all IDDM patients, eventually develop some background changes in the eyes. A proportion of patients will suffer from proliferative retinopathy, the sight threatening form of diabetic eye disease (Mitchell, 1985; WHO Diabetes Study Group, 1985). Detailed information on diabetic retinopathy is not available in New Zealand, but it is clear from the high attendance on hospital inpatient and ambulatory ophthalmological services that this complication affects a large number of diabetic persons in New Zealand.

Hyperglycaemia also damages the delicate capillaries of the kidneys, thus impairing their filtration and excretory functions. The most important fact about diabetic kidney damage is that the extra burden placed on residual functioning tissue, especially in the face of high blood pressure, leads to progressive renal deterioration (WHO Diabetes Study Group, 1985). Stringent diabetic control will not arrest the pathway to end-stage renal failure once structural damage has occurred. The only options for continued patient survival are control of blood pressure, renal dialysis or kidney transplantation.

In addition to these vascular complications, diabetic individuals are also prone to peripheral and autonomic neuropathy. Peripheral neuropathy involves sensory defects such as the loss of feeling, sensation of pain or the absence of reflexes. Loss of nerve sensitivity may occur subtly and gradually over many years, or it can

be severe, acute and very painful (Ellenberg, 1982; WHO Diabetes Study Group, 1985). If the motor nerves become affected, muscle weakness and isolated paralysis can also occur. Autonomic neuropathy is a chronic irreversible form of neural damage which includes sexual dysfunctioning, disturbed cardiorespiratory functioning, and gastrointestinal and urinary bladder disturbances. Impotence in the diabetic male is perhaps the most common, yet untreated, autonomic neuropathic complication of diabetes. Over half of diabetic males may eventually experience some form of sexual dysfunction (Faerman and Faerman, 1986).

Each of the disorders listed in Table 5.2 impact heavily on the diabetic individual. The consequences for health are magnified considerably when it is understood that many of the health problems associated with diabetes occur concurrently. For example, those suffering from proliferative eye disease are also likely to have renal problems and those with coronary heart disease, peripheral vascular problems. The exact nature of the relationship between the primary derangement in glucose metabolism that occurs in diabetes and the development of vascular and neurological complications is unclear. In general, the frequency of complications, their severity and progression, appear to relate to the duration of the disorder and to the degree of prolonged hyperglycaemia. Skyler (1979) reports that clinical, epidemiological, biochemical and animal studies indicate that diabetes complications are secondary to the basic metabolic disturbance and that diabetes sequelae may be prevented, reduced in severity, arrested or delayed, if a high degree of metabolic control is sustained over time.

### 5.5.2 Mortality

Given these problems, it is not surprising that diabetic persons have a reduced life expectancy. Diabetes currently ranks as the fourth to eighth leading cause of death in developed countries (WHO Diabetes Study Group, 1985). In the United States, diabetes contributes to more deaths than either lung cancer, breast cancer, motor vehicle accidents or infant mortality (source: US National Diabetes Data Group). In New Zealand in 1985, diabetes was officially identified as the principal underlying cause of death in 1.5% of deaths, a crude death rate of 12 per 100,000. However, as the following discussion will indicate, diabetes involves a much higher level of mortality than is officially recognized.

Despite general medical advances of the last sixty years, the risk of mortality in diabetic persons is still high relative to the non-diabetic population. Age standardized mortality rates are typically two to three times higher in patients with maturity-onset NIDDM and up to 20 times in childhood onset IDDM cases (West, 1978; Dorman et al, 1984; Green et al, 1985; Panzram 1987). Life expectancy of diabetic individuals is significantly less than that of the general population in all age groups age except the elderly (Bale and Entmacher, 1977).

Life expectancy of insulin requiring diabetic individuals rarely exceeded one or two years after the onset of diabetes before the introduction of insulin therapy in 1922. Although the chances of IDDM children surviving the first 12 months after diagnosis and the first ten years of diabetes have improved significantly over time

(Dorman et al, 1984), the impact of insulin treatment on overall rates of mortality has been slight because the majority of deaths occur in middle aged or elderly patients who gain little benefit from this form of treatment.

Rates of mortality are especially high in persons with IDDM. Dorman and co-workers (1984) using the well established Pittsburgh IDDM patient register, studied mortality in a cohort of young IDDM patients. Three percent of this study population died within the first 10 years of diagnosed diabetes, 12% within 20 years after onset and 29% were deceased at 30 years duration. A comparison of age-specific mortality rates between the white IDDM study population and the white US population, showed that the level of mortality was substantially higher in the diabetic group at every age and for both sexes (Table 5.4). Overall, there was a seven fold excess in mortality when compared with the US population of the same age. Over 2% of diabetic patients aged between 25 and 40 years died each year which, according to Dorman and his co-workers, is about twenty times higher than that experienced by non-diabetic persons of a similar age.

Connell and Loudon's (1983) study of mortality in diabetic persons aged less than 45 years living in Washington State reveals two rather surprising findings. First, the data did not support their expectation that, as a consequence of improved understanding of diabetes and better provision of medical care, there would be a decline in mortality during the 12 year study period (1968-1979). There was no clear temporal trend and the average age at death remained the same in each of eight categories of cause of death they

**TABLE 5.4**  
**MORTALITY IN WHITE AMERICANS WITH IDDM**

Age	Males		Females	
	Mortality Rate Per 1000	Overall SMR	Mortality Rate Per 1000	Overall SMR
1-4	2.4	261	19.0	2606*
5-9	3.0	633*	4.7	1437*
10-14	1.3	283	2.4	882*
15-19	2.6	182	1.4	270
20-24	6.8	363*	5.0	823*
25-29	15.9	947*	20.1	3055*
30-34	29.6	1728*	14.6	1699*
35+	43.2	2057*	-	-
Total	6.4	540*	5.8	1153*

\* Significant at  $p = 0.01$ , SMR is standardized mortality ratio (age-sex matched to general population).

(Source: Dorman et al, 1984).

identified. Second, since medical resources were concentrated in the urban areas, they expected to find differences in mortality rates between the metropolitan and rural counties. Neither deaths from acute complications nor overall mortality rates were related to residential area of the patients and therefore to areas of differing medical resource availability, "suggesting that the problem is not simply a reflection of resource or specialized facility shortage" (Connell and Loudon, 1983, p1176).

Measuring mortality in NIDDM populations is problematic because this group is ill-defined in the community. In general, the long term prognosis of NIDDM patients is also poor relative to the non-diabetic population. Excess mortality tends to be more significant in the younger aged NIDDM patients whilst patients aged 65 or more years seem to have similar rates of survival (Sasaki et al, 1983). The predominant cause of death in NIDDM patients is cardiovascular disease. In America, ischaemic heart disease contributes to 50% of deaths in persons with NIDDM, stroke 15%, other cardiovascular problems 10% and renal failure 8% (WHO Diabetes Study Group, 1985). Diabetic individuals are much more susceptible than age-matched non-diabetic persons to sudden death from heart attacks and death from renal failure (Harris and Entmacher, 1985).

IDDM and NIDDM patients have different mortality risks through differences in their age at onset and duration of diabetes, and the pathogenic processes associated with each type of diabetes. Findings of the Pittsburgh (Dorman et al, 1984) and Washington State (Connell and Loudon, 1983) studies confirm that the majority of

IDDM patients, particularly those aged 20 or more years, die from renal disease. Mortality from renal disease in young diabetic patients is approximately 500 times greater than that experienced by people of the same age in the non-diabetic population. Cardiovascular disease is also an important cause of death in IDDM patients. The number of cardiovascular deaths in the young Pittsburgh study population was more than 11 times greater than what would be expected among non-diabetic individuals of the same age (Dorman et al, 1984). The acute complications of diabetes are the main cause of death in diabetic persons under 20 years of age. Ketoacidosis, hypoglycaemia and infection contribute to at least half of all the deaths in diabetic children and adolescents.

Severe diabetic ketoacidosis (DKA) and coma remain lethal conditions. Mortality ranges from 5-15% in specialized centres and up to 25% in other hospitals and is especially high in elderly patients (Alberti, 1982). In the United States during the period 1970-1978, DKA accounted for 8-10% of all recorded diabetic deaths (Holman et al, 1983). Of all the patients identified as dying from this cause, 1.6% were under 15 years of age, 13.6% were aged 15-44 years, 29.1% 45-64 years and 55.7% were aged 65 or more years (Holman et al, 1983). The large number of deaths attributable to the acute diabetic complications of ketoacidosis, hypoglycaemia, and infection, are disturbing because these conditions can be treated and should largely be preventable through existing diabetes management practices.

Diabetes leads to premature death and excessive levels of mortality, but it is important to note that because of technical

difficulties with reporting cause of death, the true mortal impact of diabetes is often masked. Most mortality measures are derived from international methods of death certification where only one principal underlying cause of death is required. Diabetes is often viewed as an insidious chronic disorder and is therefore often overlooked as a cause of death in favour of more 'visible' factors like cardiac arrest or stroke (Tokuhata et al, 1975; West, 1978; and Fuller et al, 1983). National mortality figures in New Zealand and overseas document underlying cause of death under separate disease classifications without taking any real account of the fact that diabetes may have been vitally important in the causation of these end-stage disease processes.

In America and Britain, diabetes is designated as the underlying cause of death on only 20-30% of all death certificates that have diabetes recorded on them (Tokuhata et al, 1975; Bale and Entmacher, 1977; Fuller et al, 1983; Herman et al, 1984). Bale and Entmacher (1977) for example found diabetes was the underlying cause of death in 1.9% of all the deaths registered with the Iowa State Department of Health but a contributory cause in 7.1%. Additionally, diabetes may not be mentioned at all on 30-60% of death certificates of deceased diabetic individuals (Palumbo et al, 1976; Tokuhata et al, 1975; Fuller et al, 1983). Tokuhata and colleagues in their analysis of diabetes mortality in Pennsylvania state "The fact that only 2639 diabetic deaths were officially counted when, in fact, as many as 18,920 persons died with the disease clearly indicates an extremely poor visibility of diabetes as a cause of death" (1975, p25).



## 5.6 CONCLUSIONS

This chapter set forth to explain what diabetes is and to examine its impact in terms of morbidity and mortality. Although it has not always been recognized as such, diabetes is justifiably termed a major public health problem in industrial societies. Diabetes affects at least 100,000 New Zealanders (Neal and Beaven, 1988). Approximately one adult in every twenty has diabetes. The occurrence of diabetes in the New Zealand Polynesian population is three-four times higher than that in European New Zealanders. One half of adult individuals in which clinical diagnosis of diabetes could be established, go undetected. These individuals will be unaware that this untreated diabetes is causing major damage to their vascular and neurological systems.

There is no reason to believe that the occurrence of diabetes will diminish in the near future. Rather, with an ageing population and with existing trends in social behaviour, New Zealand can expect the rate of diabetes prevalence in the community to increase. Each and every one of these individuals will require on-going medical attention to treat and minimize the health outcomes of diabetes.

Individuals with diabetes remain a high risk health group. They are prone to the acute diabetic problems of hyperglycaemia, ketoacidosis, hypoglycaemia and infection. These disorders continue to contribute to unnecessary impacts on health, especially in persons with IDDM, and as will be seen in later chapters, to many potentially preventable admissions to hospital.

It is true that modern medical methods have reduced the mortality and morbidity associated with the acute complications of diabetes. However, as an outcome of this, patients have assumed increased risk of the development of the long term complications of the disorder. These severely threaten quality of life. Undoubtedly, the major health cost of diabetes is the morbidity and mortality associated with its long term complications of macrovascular, microvascular and neuropathic disease.

Macrovascular disorders, such as heart attack, stroke, peripheral vascular disease, are more frequent and more severe in diabetic persons than in age-sex matched individuals without diabetes. Lower limb amputation is all too common in persons who have had diabetes for many years. The microvascular diseases of the eyes and kidneys are hallmarks of diabetes. Their impact on health is severe. Diabetic individuals are prone to visual impairment, blindness and end-stage renal failure. These disorders typically affect young and middle-aged adults who have had IDDM since childhood.

Although some improvement has occurred in the life expectancy of diabetic patients, their long term prognosis is still poor relative to age-sex matched non-diabetic populations. The rates of excess mortality in diabetic groups compared to non-diabetic populations are especially high for individuals with 'long-standing' IDDM. Standardized mortality ratios indicate death rates for diabetic persons aged between 25 and 40 years are in the order of twenty times higher than those expected in the general population. Deaths in the NIDDM population are typically double or treble those in matched non-diabetic populations.

As stated in the introduction to this Chapter, an understanding of the nature of the health disorder to which health care is directed is essential if services are to be appropriately delivered. Improved glycaemic control and maintenance of near normal metabolic processes improve the life chances of diabetic persons and reduce their risk of the development of diabetic complications. The pathophysiological processes involved in diabetes underly the therapeutic efforts to achieve these goals. The aetiology of diabetes is such that life style approaches to prevention and care are now widely advocated. It is to the philosophy of diabetes care and the organization of health services used in the treatment of diabetes that attention now turns.

## **CHAPTER SIX**

### **SOCIETY'S RESPONSE: THE PROVISION OF DIABETES CARE**

#### **6.1 INTRODUCTION**

This chapter investigates society's response to diabetes through the provision of diabetes care. Chapter Five discussed the nature and occurrence of diabetes and its complications and showed that diabetes poses tremendous threats to individual and collective levels of health. The disease characteristics of diabetes present a serious challenge to modern health care systems which, to date, have not coped well with the care of diabetic individuals. If health care is to be effective, then service provision must be appropriate to the basic characteristics and requirements of the health problems to which the health care is targeted.

The two empirical interests of this thesis are, firstly, to examine area variations in diabetes related hospitalization with reference to the importance of Roemer's Law, and secondly, to investigate what influence the organization of diabetes care has on the rate of hospitalization of diabetic individuals. To appreciate such relationships, it is essential to understand first of all the structural or ideological context in which this hospital utilization occurs. This necessarily involves the identification of the philosophical, therapeutic and organizational characteristics of diabetes care.

These factors reflect in how diabetes is managed on a day-to-day basis, and in the type of care provided in the community and in the hospital sector.

The aim of the Chapter is, therefore, to examine the philosophical nature and organizational characteristics of diabetes care. In the Western world, diabetes services developed as part of national health care systems. Thus, they are subject to wider societal influences, and particularly to factors pertaining to the medical model of health care (discussed in Chapter Two). This discussion locates diabetes within this wider framework, which provides a broader interpretation of diabetes care than that traditionally espoused by those actively involved in diabetes services. The discussion is applicable not only to New Zealand but is also relevant in, its general commentary, to other Western countries.

The Chapter identifies the medical model in diabetes management by examining traditional medical interests in diabetes as well as the introduction of patient education into diabetes care. It also examines the expression of these factors in terms of the actual provision of diabetes services. This provides an overview of the structure and availability of diabetes services in New Zealand, and identifies some of the organizational problems and deficiencies that have arisen from the application of the medical model to the delivery of diabetes care.

## **6.2 THE MEDICAL MODEL IN DIABETES MANAGEMENT: PHILOSOPHICAL APPROACHES IN DIABETES CARE.**

There is no doubt that the goals of 'diabetes health care systems' are admirable. These include:

- (1) primary prevention of diabetes with emphasis on the identification of individuals at high risk;
- (2) early detection, diagnosis and instigation of diabetes therapy;
- (3) minimizing the risks of diabetes health problems; and
- (4) social adaptation such that the disorder has minimal interference with normal living (WHO Study Group on Diabetes Mellitus, 1985; Bajaj and Madan, 1986).

Health services have, however, made little inroad into achieving these goals. A hiatus remains between diabetes health problems and the provision of health services as solutions to these.

### **6.2.1 Intervention versus Prevention**

Although primary prevention of diabetes is the most desirable goal, it has not been actively pursued. The two key international non government health agencies with responsibilities, either in advisory or active capacities, towards diabetes care, are the World Health Organization (WHO) and the International Diabetes Federation (IDF). Both have promulgated the need for world-wide primary prevention of the disorder. Despite their proclamations, which are reinforced by calls from health experts for individual countries to adopt non-

communicable disease programmes, no comprehensive strategy aimed at diabetes prevention has ever been implemented on a national scale. Preventive action has to date been targeted only at a few very small and highly selective population subgroups.

In New Zealand, as in other countries, the responsibility for diabetes public awareness programmes has fallen to lay diabetes organizations. However, national diabetes associations and their community affiliates are typically constrained by limited finances, a lack of educational resources, public exposure, membership support and backing from the local medical community. All of these are necessary to mount on-going public health campaigns required to effect large scale change in the community. Projects usually centre on community screening of diabetes, which is case finding rather than prevention. They reach only a small proportion of the total population, and although imparting some knowledge to these people, there is no assurance such information will be translated into the desired modification of behaviour. Such programmes do, however, play an important political function. The community perceives some form of action is being undertaken, yet these campaigns place no demand on national resources and pose no threat to the underlying fabric of society in which diabetes is developing.

Whereas it would be untrue to suggest that there is no concern with the health impact of diabetes, approaches adopted have been remedial based and very selective. The United States is the country most notable for its intervention policy to combat diabetes health problems. The Centre for Disease Control (CDC) in Atlanta, for example, has assumed a problem-oriented approach towards the

secondary prevention of diabetes complications. CDC has now initiated diabetes control demonstration programmes in some 20 states. These strategies are based on 'proven effective' therapies and are targeted at specific diabetes-related morbidities, namely, diabetic ketoacidosis, lower limb amputation, end-stage renal failure, diabetic eye disease and adverse outcomes in pregnancy (Ring, 1986).

Primary prevention of diabetes is not perceived as a major health priority for several reasons. First, there is a lack of awareness of the health, social and economic costs of the disorder. The political impetus needed to instigate public health programmes to combat it is therefore missing. Second, most countries do not have the essential epidemiological data to: (1) justify the need for intervention; (2) gain priority and therefore resources; and (3) target programmes. Third, community control programmes based on lifestyle change and modification of health-related behaviour, which the aetiology of diabetes demands, are difficult to formulate and implement in practice. Programme efficiency and effectiveness are debatable since non-communicable diseases like diabetes lack aetiological specificity between risk factors and occurrence. The overall benefits to health cannot be accurately assessed, and as a consequence, State expenditure on such programmes may not be seen to be warranted. Furthermore, actions founded on widespread lifestyle change can be structurally challenging and are therefore politically unappealing.

Diabetes care is encapsulated within national health care delivery systems and these are not designed to tackle root causes of chronic diseases such as patterns of diet, exercise, stress, or dangers



in the work place and physical environment. Health systems are symptom oriented, coping with specific disease entities once they are manifested.

Even though the health services of different countries vary, diabetes care is still provided within the national health care system, in Britain, for example, under the auspices of the National Health Service, in America in its market-driven private health care system, and in New Zealand in what has increasingly become a dual public-private service mix. Diabetic patients obtain care from a variety of health services, some are specific to diabetes but all are part of the more general provision of health care that is available to a country's population through its hospitals and doctors.

Diabetes care reflects the relations and conflicts that exist within the health care system as a whole. Health services and research funding are, for example, heavily oriented to the treatment of individual patients expressing episodic illness. Few resources are allocated to preventive health care for the greater collective. The thrust of diabetes care, therefore, has been towards therapeutic intervention both with respect to the primary management of the disorder and treatment of diabetes complications.

The primary function of the medical profession in terms of diabetes is to take care of and administer the health problems that arise with the disorder. Their tasks or aims are to:-

- (1) preserve life and relieve symptoms
- (2) normalize glucose metabolism as far as possible
- (3) prevent, detect, arrest or delay, the chronic as well as the acute metabolic complications of the disorder
- (4) promote sound nutrition and acceptable body weights in affected persons
- (5) provide for normal growth and development and
- (6) promote social and emotional well-being of the diabetic person and supporting family unit (Hunt, 1981; Beaven et al, 1988).

These aims are facilitated through various therapeutic intervention and diabetes management strategies, strategies generated from within the health care system. There are two treatment themes in diabetes care: clinical care which dominates service provision and patient education. Both treatment philosophies are defined by and serve the medical model (outlined in Chapter Two). Clinical intervention typifies the traditional mechanistic approach to health care whilst patient education reflects medical imperialism and the co-optation of lifestyle politics into health.

### **6.2.2 Orthodox Medical Interests in Diabetes Care**

The traditional interests of medicine are clearly evident in, and are still very well served by, diabetes care. Patient education (to be discussed shortly) has been heralded as the modern philosophical base of diabetes care, an approach which is seen to challenge many traditional medical beliefs and practices. Because patient education, being the major growth area in diabetes, has attracted so much

attention in recent years, the real structural dominance of the traditional interests of medicine has gone unnoticed. However, if one stands back and looks at the health services that are used by diabetic persons and the structure of these services (availability and deployment of resources, service interaction, division of the workforce, administrative control etc.) together with the main areas of research and funding, then it becomes abundantly clear that orthodox medical interests dominate the organizational and utilitarian constructs of diabetes care.

This is not at all surprising given that: (1) diabetes care derives from a network of health services whose individual development reflects the hegemony of scientific and clinical interests in medicine. Health services provided in the treatment of specific disorders like diabetes are, for research and discussion purposes, seen collectively to comprise discrete systems but such services are part and parcel of a country's total health care system and are therefore not only subject to but also manifest the conflicts and relations existing within the health care system as a whole; and (2) as evidenced in Chapter Five, the health consequences of diabetes constitute a very large working domain in terms of clinical practice and the need for therapeutic intervention. In addition, because so many areas of diabetes are so poorly understood, the disorder presents ample opportunity for the expression of research interests. Such interests lie as much with the more esoteric branches of medical science as with clinical research. A considerable amount of scientific and clinical work is devoted to both: (1) diabetes etiopathogenesis, physiology and primary metabolic management; and (2) the secondary prevention and treatment of the acute and long term complications of the disorder.

Metabolic derangements, infection, and the various microvascular, macrovascular and neuropathic complications of diabetes are all treated through clinical intervention and medical expertise found in the primary but more particularly in the hospital sector. These problems are widespread, they impact heavily on patients' health and they draw on many medical resources. There is a plethora of clinical and scientific literature in diabetes journals and those of the medical specialties that documents diabetes morbidities and their treatment. It is sufficient to state here that treatment is heavily oriented towards pharmacological intervention either in isolation or in combination with intensive clinical and highly specialized surgical procedures (e.g. laser photocoagulation, vitrectomy, renal dialysis, penile prosthetic implantation, by-pass surgery, organ transplantation). In fact, a diabetic person has only a 50% chance of avoiding surgery during his/her lifetime (Alberti, 1982; WHO Study Group On Diabetes, 1985). Hospital care demands intensive and extensive nursing and specialist medical input, and involves a vast array of equipment and technological support. Additionally, general practitioners being the patient's first point of contact are responsible for the detection of complications, the instigation of appropriate therapy, the arrangement of necessary referrals and the provision of on-going follow-up care.

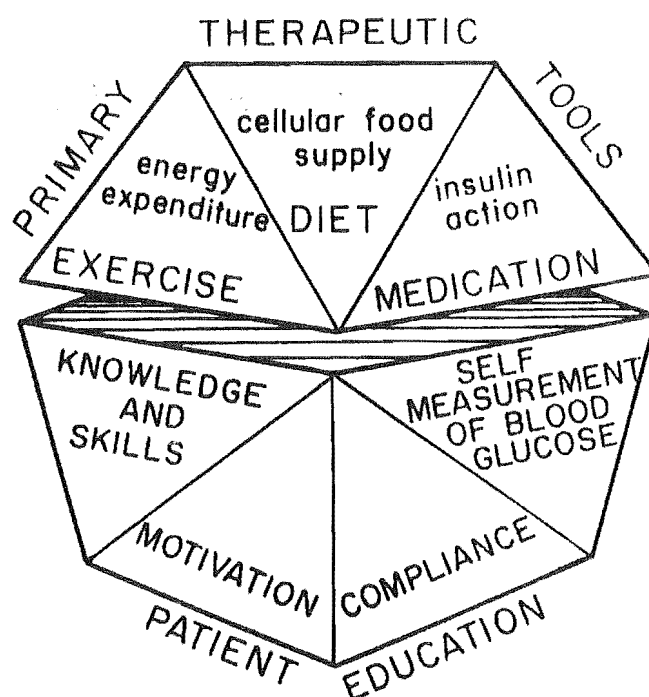
Substantial resources are devoted to the clinical care of diabetic patients. Like the rest of the community, people with diabetes have come to believe in the therapeutic abilities of modern medical practices - when something goes wrong, doctors can make it better. Although clinical based care certainly improves the health of

many diabetic patients, faith in therapeutic effectiveness is often misplaced, for example: some drugs and surgical and clinical procedures simply do not work in some patients; treatment may be successful for a period of time but subsequently fails; therapy may yield little benefit or it may be too late to effect any appreciable change; intervention whilst improving a patient's condition, does not usually restore health to the pre-morbid state; and most procedures do not ensure on-going health maintenance and prevention of problems in the near or distant future. The acute and chronic complications of diabetes constitute an extensive and powerful working domain for the medical profession, who along with the medical-industrial complex have much invested in the continued provision and use of clinical services even though benefits to patients' health are not always seen.

The nature of the medical profession's role in the treatment of diabetes has been changing particularly with respect to the primary management of the disorder outside the hospital environment. Diabetes control is the outcome of complex processes involving metabolic, pharmacological and psycho-social factors. The rationale of its treatment from the perspective of the medical model, is simple. The disorder is incurable (for all intents and purposes). Fundamental physiological abnormalities in the supply and utilization of glucose therefore have to be controlled via external intervention.

The variable triad of diet, exercise and medication (insulin and oral hypoglycaemic agents) are the primary therapeutic tools of diabetes management (Figure 6.1). Normal blood glucose concentrations persist as long as there is a balance in the metabolic

factors of cellular food supply, energy expenditure, and insulin action. Diet, exercise and antidiabetic medication are manipulated in the hope of achieving this energy balance. The therapeutic use of diet, exercise and insulin action is discussed in Appendix B.1. It is, however, pertinent to make a few comments concerning some of the difficulties and complexities with diabetes control.



**Figure 6.1:** The Seven Therapeutic Faces of Diabetes Management

Dietary therapy is essential for all diabetic individuals because glucose metabolism is directly affected by quantitative and qualitative factors of diet. Patient compliance with dietary recommendations is, however, notoriously poor. Changes required in nutritional behaviour are substantial for many individuals, and therapeutic

recommendations are often unrealistic with respect to individual and family food preferences, and in terms of the patient's social, cultural and economic background. Diabetes therapy is problematic because by affecting diet, diabetes impacts on one of the most value-laden and intimate parts of people's lives.

Physical activity, also plays an important role in metabolic homeostasis both through the acute impact of physical exertion on glucose utilization and through the benefits of physical training in augmenting the biological effects of insulin, in improving cellular insulin sensitivity, and in reducing obesity. However, the glycaemic effects of exercise are very individualistic and are conditional on many antecedent metabolic and physiological factors. Exercise is virtually impossible to prescribe other than through general recommendations. Individuals with insulin-dependent diabetes (IDDM) are at risk to exercise induced hypoglycaemia during and after physical activity which often compromises their behaviour and attitudes towards exercise activities.

Simplistically, pharmacological intervention in diabetes control involves either the administration of exogenous insulin or the use of oral hypoglycaemic agents. Insulin therapy was first introduced into diabetes management in 1922 and oral hypoglycaemic agents in the mid 1950s. Lost endogenous insulin supply is replaced predominantly through daily multiple subcutaneous injections of biosynthetic human, bovine or porcine insulin. Contrary to most other medical conditions, in insulin dependent diabetes, patients are expected and are taught to administer and adjust insulin injections themselves.

Insulin regimes attempt to mirror physiological insulin release. However, current insulin therapy does not replicate normal physiological processes. There are inter- and intra-personal variations in insulin kinetics which frustrate the establishment of treatment regimes and the normalization of blood glucose levels. It is difficult to accurately match insulin availability to dietary and exercise requirements because these fluctuate during the day whilst insulin release is predetermined pharmacokinetically and through its administration (a fixed dose at a fixed point in time). Insulin therapy should also be viewed as being occasionally potentially iatrogenic and lethal, the most significant hazard being hypoglycaemia.

Oral hypoglycaemic agents are used in the treatment of individuals with non-insulin dependent diabetes (NIDDM) in whom diet and exercise have not yielded satisfactory glycaemic control (about half of all NIDDM patients can be treated by dietary modification alone). Antidiabetic drugs (sulfonylureas and biguanide derivatives) are not insulin, rather, they enhance endogenous insulin action. They are therefore only useful in patients who retain insulin production (Ramirez, 1982). In addition, as Lebovitz highlights "These drugs are an adjunct to dietary management and are rarely effective if some type of dietary management is not part of the therapeutic regime" (1986, p74). Like insulin therapy, use of oral hypoglycaemic agents is not without its problems - hypoglycaemia, inadequate glycaemic control, and risk to lactic acidosis through the inappropriate use of the biguanides (Menhert, 1982 Skyler, 1982; Czyzyk, 1986).



Within the traditional clinical approach to care, it was natural for general practitioners and diabetes specialists to assume control over the prescription and use of diet, exercise and antidiabetic medication in their management of diabetic patients. Clinical care centred on systematic medical review of patients. This included physical examination, biochemical profiling, treatment of acute problems on presentation, identification of potential problems, institution of corrective therapy, review and adjustment of therapeutic regimes, prescription of drugs, and arrangement of necessary tests and referrals.

However, the balancing of diet, exercise and insulin is no easy task. What the body does automatically in health, must be replicated through non-physiological intervention and conscious decision-making in an information-poor environment. Diabetes control is a term used to describe the integral of fluctuations in diet, exercise and insulin action. Blood glucose levels are very sensitive to changes in these variables.

There is no doubt that patients live longer now than prior to the 1930s but at the expense of diabetes complications. The quality of diabetes control remains poor from a physiological point of view and health outcomes less than satisfactory. The assumption by both doctors and patients that one-off appointments would allow assimilation of all essential data needed to prescribe treatment to facilitate good diabetes control was naive. Also assumed was patients would adhere to the therapeutic requirements laid down by their doctors. It is now appreciated that this physician dominated approach in which the diabetic individual is treated as a

symptomatic patient, is unrealistic in achieving and maintaining good glycaemic control in most diabetic persons. As a New Zealand diabetes specialist stated in the early 1980s:

"Many diabetes centres throughout the world have now recognized that conventional management of diabetes, i.e. treating diabetes on a strictly medical basis, has so many short-comings that it is rendered ineffective in producing any noticeable gain to the patient in terms of better control or reduced morbidity. The treatment of diabetes is too complex to be handled by the simple therapeutic approaches often successful in other disorders..." (Scott, 1981, p21).

## **6.3 DIABETES CARE RE-ORGANIZATION THROUGH PATIENT EDUCATION**

### **6.3.1 The Philosophy of Diabetes Patient Education**

The aims of diabetes care are attainable if the primary tools of diabetes therapy can be used more effectively. Diabetes education programmes were introduced into health care delivery systems in the late 1970s in the belief that they singularly represent the most important approach to the day-to-day management of diabetes. Diabetes patient education embodies two important principles: (1) behavioural modification; and (2) patient self-care. An approach incorporating these two principles is viewed by many health care providers as being the only realistic way to minimizing the health consequences of high blood sugars and blood fats. As the WHO Study

Group on Diabetes state "In the daily management of diabetes, active participation of patients appears to be only efficient solution for the control of the disease and its long term complications" (1985, p77). A diabetes service lacking an educational component would now be considered totally inadequate.

The functional role of diabetes education is to facilitate effective therapeutic use of diet, exercise and medication by patients in controlling their own diabetes. The process of education involves the communication of concepts and skills to patients to make them act and react in the best possible way (as professionally defined) (Alivisatos and Benroubi, 1986). Diabetes educational programmes aim specifically to:

- (1) provide patients with an elementary physiological understanding of diabetes,
- (2) impart therapeutic knowledge, i.e. instruct on dietary, exercise and insulin requirements for improved metabolic control and normalization of blood glycaemia,
- (3) teach patients essential skills such as food preparation, cooking techniques, insulin administration, insulin adjustment, exercise activities, foot care, care during illness, measurement of blood glucose levels *etc.*
- (4) encourage the early detection and self-treatment of disturbances of glycaemic control (hypoglycaemia and hyperglycaemia),
- (5) promote the importance of good glycaemic control in preventing end-stage complications,

- (6) promote patient motivation and compliance, and facilitate the translation of knowledge and skills into day-to-day management practices,
- (7) encourage patient responsibility in the management of their diabetes; and
- (8) provide counselling and social support services to diabetic individuals and their families (Beaven and Scott, 1982; Beaven et al, 1988).

There is now a volume of literature on diabetes education. The key message emanating from this literature is that patients must not only acquire diabetes knowledge and skills, but more importantly, they should apply these in the day-to-day management of their diabetes, that is, diabetes education must lead to attitudinal and behavioural change and not just improvement in patients' knowledge.

Many health professionals argue conventional diabetes therapy fails because patients (not doctors) neither have the interest, knowledge nor the skills necessary to effect good diabetes control on an on-going basis. "Increasingly accurate methods for improving health status through meticulous monitoring and control of blood sugar are being developed for people who have diabetes. However, until individual patients can apply these techniques without error and base their actions on appropriate decisions, optimal control will not be achieved..." (Ruzicki, 1984, p372). Patient knowledge, desire to behave in a defined way (motivation) and the extent to which patient behaviour conforms with the advice and expectations of the providers of diabetes care (compliance), are consistently accepted as key educational determinants of diabetes control (Figure 6.1). Even

apparently simple diabetes management tasks are poorly performed by many patients (Lawrence and Cheely, 1980; Etzwiler, 1984; Lockington et al, 1987).

In the last few years health belief and health locus of control models (Ruzicki, 1984; Becker and Janz, 1985; Hiss, 1986; Harris et al, 1987; Edelstein and Linn, 1987; Williams et al, 1988) have been put forward as key explanations of the behaviour of diabetic individuals. Such behavioural models attempt to explain diabetes control and issues of non-compliance as a function of the degree to which patients are motivated or interested in their health (Hiss, 1986), that is in terms of individual psycho-social characteristics (similar to Rosenstock's health service use model in Chapter Four). The following statement summarizes this viewpoint, "The ability and motivation of patients to learn about their disease and to assume an active role in its treatment is closely related to their particular health beliefs, their personality structure, their actual psychosocial situation, the presence of disease- and/or treatment-related symptoms, the prognosis of their disease(s), and their ability to cope with and actively accept their disease" (Assal et al, 1985, p604).

There are major methodological problems involved with psychological models which brings into question their relevance, validity and usefulness in diabetes management (Williams et al, 1988). Williams, Pickup and Keen ask "although psychological problems are undeniably associated with poor metabolic control, are they cause, consequence or merely coincidence?" (1988, p211). Moreover, by focusing in on individual behaviour, many issues which are fundamental to good diabetes care are ignored or passed over. For

example, medical expectations concerning therapeutic behaviour and prescribed courses of action, such as dietary practices or SMBG, are often unrealistic for patients to pursue practicably at home or in the work-place. Furthermore, the actual tools of diabetes treatment are frequently inadequate for the tasks required.

People with diabetes live as part of a society which interprets health behaviour and health care in certain ways and which expects and accepts certain behaviour from its members. Structural forces underlie many patient actions, for example, diabetic persons are influenced by: (1) the way in which the community perceives and reacts to diabetes and diabetes care; (2) the short and long term benefits to be accrued from treatment; (3) whether benefits outweigh the costs imposed by behaviour changes; (4) what social obligations and work tasks have to be performed; and (5) what type of behaviour will be legitimately tolerated by society. There is much more to diabetes control than just patient ignorance and non-compliance, after all patients' attitudes and behaviour derive from somewhere!

Another educational element in diabetes control is the self-measurement of blood glucose levels (SMBG) by patients using small optical reflectance meters and visually or meter read reagent strips (Figure 6.1). SMBG is regarded as being very important because it provides accurate and easily obtainable data on diabetes control reflecting fluctuations in diet, exercise and medication. Measuring blood glucose levels enables effective changes to be made in treatment regimes, stimulates modification of patient behaviour and

motivates patients to comply with therapy (Cohen and Zimmet, 1983).

SMBG is now an integral part of diabetes management. Many patients have improved their diabetes control through this technique but its effect overall is questionable (Mountier et al, 1982; Petranyi et al, 1984). For example, despite its reputation as a key management tool, many patients do not test or test too infrequently. In America, studies have indicated that only 5% of persons with NIDDM and just over 25% of IDDM patients perform their own blood glucose tests with almost one-third of patients not testing at all (Hayes-Coughlin and Kahn, 1986). Additionally, many patients have poor technique which renders the results virtually useless, and up to two-thirds of patients actually falsify or obscure self-measurement of blood glucose data (Mazze et al, 1984). As with the acquisition of diabetes knowledge, if good diabetes control is to result from patients monitoring their blood glucose levels then the information gleaned must also be therapeutically acted upon.

More subtly, this technique has created for patients a situation of 'learned-helplessness' and dependency (Stuart Dunn 1988, *pers. comm.*). Every time patients test their blood glucose which they are expected to do frequently, they are also testing themselves against medical standards and expectations. Diabetes care providers stress the importance of the normalization of blood glucose levels because even very mild hyperglycaemia may be dangerous to health (Fuller et al, 1980; Beaven, 1982; Scott and Cooper, 1985). However, this feat is difficult to accomplish and the personal costs imposed on patients through restrictive diabetes treatment regimes are often perceived

by them as too high a price to pay for normoglycaemia. Quality of life may be severely compromised by rigid diabetes management practices which may yield only marginal improvements in control.

Patient education is promoted by many diabetes care providers as the most important form of medical treatment of diabetes. It has taken 50 years for diabetes education to be established into diabetes management. Pioneers of diabetes care, namely Joslin and Lawrence, identified patient education as an important part of diabetes therapy as early as the 1920s (Assal et al, 1985) but the growth of institutionalized medicine forestalled any real development. The introduction of patient education into diabetes care in the late 1970s was heralded as a major reformation of diabetes services. However, acceptance of education into diabetes practices is understandable in light of two structural features. First, diabetes education represents an expansion of medical interests into daily life and is therefore consistent with the general trend of 'medical imperialism'. Second, this modern approach reinforces many traditional medical values (which might also explain in part why the potential benefits to be gained from 'education' have not been fully realized). Consider the following:

**(1) Therapeutic Orientation:**

"Education has thus become a therapeutic measure which necessitates just as systematic approach as that used in the prescription of medicine" (Assal, 1981, p6). A diabetic regime is lifelong, full of complexities and pitfalls, requires large scale behavioural change, often involves multiple daily injections of insulin



and oral medication and in all cases dietary vigilance, frequent monitoring of blood glucose levels, and patient assiduity in safety and health maintenance practices. Education is seen as a remedy to problems which hinder diabetes control. Educational services: teach diabetic individuals basic diabetes knowledge and skills; they provide therapeutic goals; they inform patients of the need for behavioural modification; and they facilitate and encourage this. Patient education treats the lifestyles and behaviours of persons with manifest diabetes. Little is done towards collectively changing the social environment in which diabetes develops and in which diabetic patients live.

## **(2) Individualism:**

The traditional medical emphasis on the individual is accentuated in modern diabetes management. Patient education developed in the afterglow of the protest years of the 1960s in a climate of increased concern for the individual, mounting distrust and aversion for authoritarianism and growing emphasis on lifestyle politics (Etzwiler, 1984). Groups demanded that individual rights be recognized in health care. Diabetes care is philosophically and practically oriented to the care of the individual patient. Self-care is regarded as the founding principle of diabetes education. Day-to-day management of diabetes is promoted as the individual's responsibility. Behavioural research in diabetes care is simply reinforcing emphasis on the individual. Failure of therapy is being equated to failure in individual behaviour (e.g. the patient's or family's lack of knowledge, management skills, motivation, compliance, attitudes, lifestyle patterns). Patient education has facilitated and

provides great potential for improved health outcomes, but the dominance of individualism and behaviouralism in its approach, means fundamental problems with diabetes care, namely treatment efficacy, are obscured and the structural forces which instil values into people and which govern patient and professional activity are ignored.

### **(3) Social Control:**

Diabetes care exemplifies the use of medicine as a form of social control. Patient behaviour is directly influenced by the actions of diabetes health professionals in providing and instructing on diabetes care and through the establishment of diabetes regimes. Patients attend educational classes, give insulin injections, undertake self-monitoring of blood sugars, plan meals and select food choices for example. Influence is also more subtly and covertly exercised over patient behaviour. Mazze (1986) states for example that patient education is consistently identified as a major strategy that impacts on beliefs connected with health related activity and patient adherence regimens. "Clearly, a major goal of patient education must be to enhance the ability of patients to comply with their therapeutic regimens and to cope with the implications of a chronic disorder and its impact on their lives" (Hess et al, 1986, p135). Diabetes services specifically attempt to promote social and psychological well-being in patients and social adaptation such that the disorder causes minimal interference to normal living.

Diabetes is the foremost chronic illness requiring participation and performance by the patient. The fundamental aim

of diabetes education is to encourage individual patient responsibility in day-to-day care. Although appropriate to its treatment, by strongly arguing that individuals must take a major role in their own health, diabetes health professionals are reinforcing the social value that health is an individual responsibility and not a collective one.

Diabetes education programmes systematically reinforce the belief that the adoption of a healthy lifestyle by the patient is the single most important form of diabetes intervention. Patients are told to modify their behaviour whilst the social milieu in which they live is left unchanged. They are required to adopt lifestyles and therapeutic practices in what amounts to an alien environment. Individuals with diabetes are essentially co-opted into an attitude and behaviour towards health and health care which are consistent with the ideology and structural needs of society.

#### **(4) Medical Dominance and Imperialism:**

Developments within diabetes care illustrate a growing appreciation of diabetes etiopathogenesis and physiology. However, the basic nature of diabetes and the broadening of understanding, has enabled the medical profession under the umbrella of patient education to extend its activities and influence well beyond its traditional domains into many aspects of the daily lives of diabetic patients. Because diabetes is a medical problem, society has legitimated this extension of medical power.

The aim of diabetes education is to increase patient autonomy in the care and maintenance of health. However, medical

dominance has been maintained in the areas that are most important. The medical profession still controls, within structural limits, diabetes research, the generation of new ideas and approaches, the dissemination of knowledge, and the provision of care. Patients do not have direct access to pharmacological agents and therapeutic aids used in diabetes management nor in the treatment of its complications. Control of these remains in the hands of the medical profession.

Most importantly, the medical profession controls the social legitimization of patient behaviour. Although diabetes care advocates and actively promotes self-care principles in patients, the medical profession has not relinquished power because diabetes management and patient behaviour are defined and monitored by the medical establishment. In practice, patients have only relative autonomy in the management of their diabetes.

More specifically, the actual organization and pedagogy of diabetes education replicates many factors inherent in the provision of clinical care. Although the structure and contents of diabetes educational programmes are continually being examined and re-organized, such care is still provided within the structural framework of the health care system which epitomizes traditional values. Those providing diabetes education are 'all-powerful' possessing the knowledge and skills which are to be passed on to the uninformed and untrained patients.

Although stated in a general vein, the following quote from the editors of the *World Book of Diabetes in Practice (Vol 2)* seems equally apt to diabetes education,

"Education is a 'sacred' word. One dare not ask questions about its necessity or effectiveness without risking the opprobrious reputation of being against progress. Unfortunately all education is not progressive nor useful. In the modern world education is often confused with propaganda, public relations or many other improper synonyms. If you oppose those in power sometimes, their response is their intent to 'educate' you" (1986, p97).

The co-existence of clinical therapy and patient education in combining biomedical, psychosocial and educational elements, is now regarded as an exemplary therapeutic model for chronic illness (Assal et al, 1985). The etiologic and pathogenic nature of diabetes certainly demands a health care approach that is founded on a true understanding of health determination (see Chapter Two). Modern diabetes management attempts to locate treatment in the day-to-day realities of the disease. Lifestyle is the cornerstone of diabetes therapy. Diabetes, perhaps more than any other disorder, illustrates the paradox of the need for providing 'non-medical' solutions to medical problems. Diabetes patient education attests to a broadening of the understanding of health, to medical imperialism and to the co-optation of lifestyle politics into modern health care (discussed in Chapter Two). Such values are reflected in the provision and structure of 'diabetes' health services.

### 6.3.2 Benefits of Diabetes Education

Expanded diabetes education services were introduced in an effort to overcome existent deficiencies in diabetes care. Numerous articles published in journals such as *Diabetes Care*, *The Diabetes Educator*, or *Diabetologia*, in the last decade have espoused the virtues and benefits of diabetes education. Some of the earliest studies reported dramatic improvements in metabolic control, reduction of complications, decrease in rates of hospitalization and major cost-savings. Diabetes self-management through effective education is regarded as being enormously powerful (Berger, 1987).

The potential benefits of diabetes care based on self-care principles and behaviour modification can be considered under two groups of outcomes: (1) improvements in both the short and long term health outcomes of diabetic persons as evidenced in improved glycaemic control, better outcomes in pregnancy, reduced occurrence of short and long term complications, improved psychological adjustment and social well-being for example; and (2) cost-efficiency with respect to health effectiveness. This involves changes in patterns of resource use particularly through reduction in hospitalization with resultant cost-savings to the system.

#### (a) *Indices of Health:*

Improvements in patients' knowledge of diabetes, their self-care skills, compliance, glycaemic control and other relevant physiologic outcomes, concomitant with attendance on outpatient education programmes are well documented in the diabetes

literature (e.g. Muhlhauser et al, 1983; Mazzuca et al, 1986). In Christchurch, Scott and others (1984) have reported reductions in glycaemic levels, increased knowledge and reduced levels of anxiety in individuals with NIDDM who attended an education course structured over four weeks. In contrast, a control group experienced increased levels of anxiety and showed no significant change in measured indices of diabetes control. Merritt and colleagues (1983) also report their goal of improving control in diabetic patients attending the Malcolm Grow USAF Medical Center (Washington, DC) via a four week instruction course was achieved with short term effects being observed in both reductions in blood glucose levels and weight.

Benefits have certainly accrued in those areas which are closely associated with the specific objectives of diabetes education programmes. For example, through a programme of education, many patients previously dependent on the district nursing service in Christchurch for drawing up and injecting insulin were able to manage the injection technique totally by themselves and others the giving of the insulin if pre-loaded syringes were provided (Scott et al, 1983). This had immediate repercussions in both relieving the work burden of the overloaded district nursing service and in reducing diabetes-related costs previously incurred by the service. Patients also gained through improved confidence and increased self-reliance.

However, whether short term improvements following attendance on education programmes are sustained over time is questionable. For example, in the Christchurch study, within a short period of four weeks after the cessation of the course, health

outcomes did not differ significantly from those measured at the time of entry (Scott et al, 1984). This called for a closer examination of the programme content and its objectives. In contrast, an intensive structured one week inpatient teaching and treatment programme established concurrently in the cities of Dusseldorf and Vienna for insulin-treated diabetic patients showed significant improvements in glycosylated haemoglobin and patient compliance rates for at least 22 months (Muhlhauser et al, 1983; Berger, 1984). Berger (1984) states, however, that while education was of principal importance in the programme's success, there was little point in artificially distinguishing between the contributions of education versus treatment efforts.

There is a paucity of longitudinal studies needed to back up the claims that patient education impacts on the occurrence of diabetes complications and mortality. The study by Connell and Loudon (1983) referred to in Chapter Five, showed no decline in mortality in patients aged 45 or less years from acute complications in the period 1968-1979. Other studies present contrasting results. For example, in Sweden mortality from diabetic ketoacidosis (DKA) in persons diagnosed with IDDM before age 22 years dropped from 9.9 deaths per 1000 person-years to 1.1 from 1935 to 1970 (Sartor and Warram, 1984). Ellemann and others (1984) have also shown reduction in deaths from DKA although the actual incidence of the disorder increased. Reductions in mortality were associated with improvements in case fatality. Merritt and colleagues (1983) did not observe a change in hospital admissions for DKA in their study but state this was probably a reflection of their patients who were largely maturity onset and not prone to DKA.



Patient education has perhaps been most convincing in terms of improving health outcomes in the area of peripheral vascular disease and more specifically in lower limb amputations. Complications involving peripheral vascular disease are amenable to intervention via patient education. Foot operations and amputations have been reduced by up to 50% through the establishment of podiatry clinics and patient education on foot care (Most and Sinnock, 1983; Edmonds et al, 1984). In Switzerland, the money saved in a year from the reduced number of lower limb amputations is equivalent to the annual salaries of the entire staff of the Geneva Diabetes Training and Teaching Unit (Assal et al, 1985).

**(b) Hospitalization:**

The impact on patterns of hospitalization of service organization centred on diabetes education is of immediate interest to this thesis. Hospitalization is a useful outcome measure of diabetes education programmes because: (1) admission to hospital is a clearly defined end-point associated with morbid events; (2) hospital costs account for a significant proportion of total diabetes health care expenditure - 46% in USA and 65% of the direct cost of medical care for diabetes in Sweden (Jonsson, 1983); and (3) reducing the number of hospital bed days reduces costs *ceteris paribus* (Sinnock, 1984). In the United States in 1980 for example, the estimated 5.5 million diagnosed diabetic individuals contributed to some 2.3 million hospital admissions (0.65m with diabetes as primary cause and 1.6 as secondary diagnosis) involving total days stay of 27 million days and \$US 7 billion in hospital costs (Sinnock, 1984). The annual

cost of hospitalization of diabetic individuals in New Zealand is in the order of \$NZ80-\$100 million (Neal and Beaven, 1988).

Inadequate patient education and care in the community are major contributors to excessive levels of hospitalization of people with diabetes. Geller and Butler (1981) found that 27% of patients consecutively admitted to a community hospital in San Diego, for short and long term complications of diabetes, had specific educational deficits and an additional 20% had a combination of educational and psychological problems.

In the State of Maine, a hospital audit of 898 diabetic charts in 34 hospitals had indicated that 16.5% of patients were hospitalized because they did not understand and therefore practice self-management skills. Hospital stay was prolonged in 10.3% of patients for the express purposes of teaching (Sinnock, 1984). CDC has now implemented a hospital-based education intervention programmes in Maine. This has resulted in a 39% reduction in hospitalization for non-stabilized diabetes and 36% decrease in length of stay at an annual saving of \$US32,000 for those patients participating in the programme when compared to control subjects (Zaremba, 1984).

A lack of attendance on outpatient diabetes education services by hospitalized patients have been documented by Fishbein et al (1982) in Rhode Island, and Scott and colleagues (1985) in Christchurch. In this latter case, only 11.7% of IDDM patients had previously used educational facilities. Admission to hospital appeared to be significantly lower in those patients who were able, and motivated, to use available education services.

Hospitalization precipitated through educational deficits and problems in community care is not just a problem of diabetes, but applies to a number of other disorders, asthma and epilepsy for example (Sinclair et al, 1987). In addition, many socially disadvantaged groups within society as a whole are also prone to hospital admission (DHSS, 1980; London Health Planning Consortium, 1981).

The overwhelming majority of studies have reported that the introduction of diabetes patient education is associated with substantial alterations in patterns of hospital utilization and increased cost efficiency. Table 6.1 summarizes results from some of the most well known studies. These have all been undertaken in the United States where there has been pressure to validate the effectiveness and efficiency of service provision. There is, however, international agreement over the advantages that accrue from ambulatory care. Audits of hospital admission have provided convincing evidence that many admissions are preventable or there is at least great opportunity for reduction in duration of hospital stay (Fishbein et al, 1982; Brown et al, 1985; Scott et al, 1985; Fishbein 1985; Damsgaard et al, 1987). This is important given the concern for the high rates at which diabetic persons utilize expensive secondary care resources. Patterns and the extent of diabetes related hospitalization will be discussed in detail in the subsequent chapters.

TABLE 6.1

## SUMMARY OF PROGRAMMES DEMONSTRATING EFFECTIVENESS IN REDUCING HOSPITALIZATION

(SOURCE: AFTER SINNOCK 1984; KAPLAN AND DAVIS 1986)

Programme	Type	Effectiveness	Selected References
Los Angeles, California	Diabetes Outpatient Clinic - integrated education and care, County Hospital - telephone hot line and admission screening	73% ↓ diabetes hospitalizations 78% ↓ average length of stay	Miller and Goldstein (1972)
Atlanta, Georgia	Outpatient Care and Education Clinic, inner city large county hospital, emphasis on diet treatment	65-70% ↓ DKA Hospitalizations 49% ↓ number of lower limb amputations	Davidson et al (1981)
Memphis, Tennessee	Outpatient care by corps of nurses decentralized neighbourhood clinics	49% ↓ diabetes hospital days after 2 years 61% ↓ admissions for DKA and infection of 17% ↑ in controls	Runyan, J.W. (1975) Miller et al (1980)
State of Rhode Island	CDC sponsored outpatient education in 6 hospitals	51% ↓ in acute diabetes related hospitalizations and 63% ↓ hospital days per person per year	Alogna, M. (1985)
State of Maine	CDC supported outpatient education in > 30 hospitals and health centres using state guidelines	32% ↓ hospital admissions (16.6% attrition rate)	Zaremba et al (1985)

**TABLE 6.1**  
**CONTINUED...**

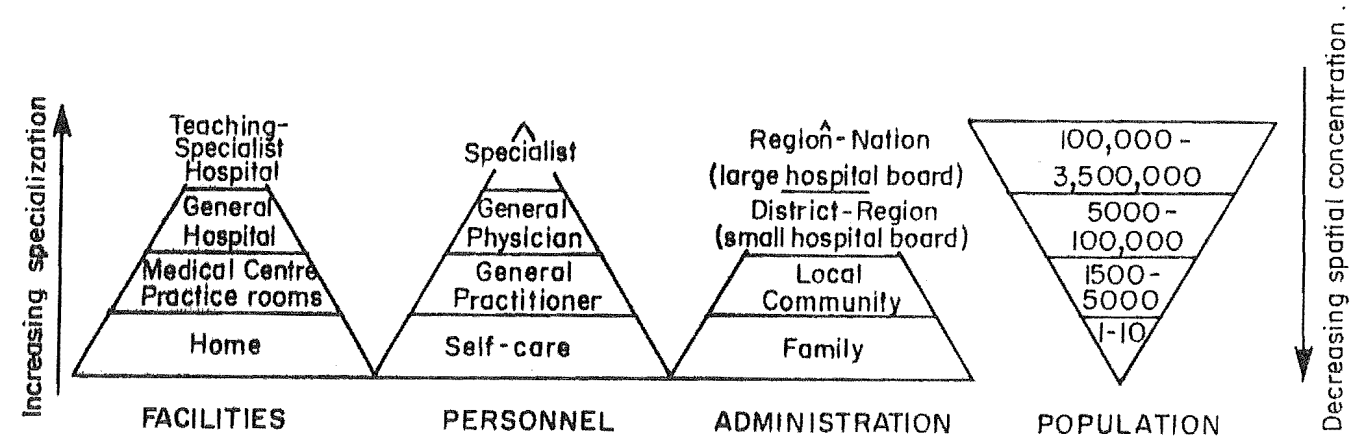
<b>Programme</b>	<b>Type</b>	<b>Effectiveness</b>	<b>Selected References</b>
Saginaw Country, Michigan	CDC sponsored trial on home visits and education	43% ↓ in rehospitalizations in 87 recently admitted diabetes patients 67% ↓ reduction in diabetes related hospitalization with no change in hospitalization rate of control group	Alogna, M. (1985)
Wright-Patterson Airforce Base, Ohio	Outpatient education program 15 hour instruction in self-care by clinic nurse	20% ↓ in hospitalization after one year follow-up ALOS went from 15 to 14 days	Jacobson et al (1983)
Andrews Airforce Base, Washington DC	Outpatient education program clinic, 2.5 hour class weekly for 4 weeks	23% ↓ admissions for uncontrolled diabetes without DKA or coma, no change in admissions with DKA 254 participants but 108 dropouts	Merritt et al (1983)

## **6.4 STRUCTURE OF DIABETES SERVICES IN NEW ZEALAND**

In New Zealand, Australia and most Western countries, diabetes educational resources were from the outset superimposed upon traditional diabetes service organizations. Individuals with diabetes in these countries construct a 'package of health resources' to care for their diabetes from a varietable mix of health services available to them from hospitals, ambulatory specialist services and primary care. The health care hierarchy and organizational structure of diabetes services in New Zealand is modelled in Figures 6.2. Diabetes services are provided within the overall framework of the health system (see for general reviews of New Zealand's health system Lovell-Smith, 1966; AJHR, 1975; McKinlay, 1980; Davis, 1981; Hyslop et al, 1983; Wilkes and Shirley, 1984; Hay, 1985; PSA, 1985B; Health Benefits Review, 1986). A review of State provided diabetes services is provided by the Diabetes Services Guidelines for Area Health Boards (Neal and Beaven, 1988).

As indicated in the previous sections, diabetes care is based on the interaction between: (1) patients, including the voluntary lay organization; (2) primary care services; and (3) the hospital sector providing secondary care, tertiary services and extramural or community based services. The hierarchy of health services in New Zealand traditionally involves the two tier system of primary and secondary care. With increased specialization in both personnel and facilities, the secondary sector can be divided into a third tier representing a higher intensity of service provision. At the primary level are the general practitioners, practice and district nurses,

public health clinics, local health workers etc.; at the secondary level are county or regional hospitals with resources and facilities for the provision of general hospital services and a certain amount of specialty care; and the tertiary level comprises centralized and highly specialized services such as those provided in large regional or national teaching hospitals (Joseph and Phillips, 1984; Persson, 1986; Kovacevic et al, 1987). For the purposes of this thesis, hospital services are referred to jointly as the secondary sector. This is of little consequence as long as it is remembered that there are differences in the degree of specialization and availability of care. Such differences are evident by the context of the discussion.



**Figure 6.2:** Hierarchical and Organizational Structure of Diabetes Services in New Zealand.

Diabetes care revolves around the individual patient and their family. In their support, are community based lay diabetes societies. The strength and importance of diabetes self-help groups varies enormously through out the world. There are 28 regional Diabetes Societies in New Zealand which provide full coverage of the country. Each region is affiliated to the New Zealand Diabetes Association (NZDA) - the national lay diabetes organization. However, total membership to NZDA is only 3000 persons, representing a very small proportion of the total diabetic population (approximately 15% of persons with known diabetes). Unlike the British or American Diabetes Associations, New Zealand's lay diabetes organization has not developed as a force in the provision of diabetes care. Diabetes services are provided by hospital or area health boards and by local general practitioners. Diabetes Societies while providing valuable support functions at the local level for their members, their role in service provision is minimal compared to the formal medical organization.

General practitioners provide many clinical services to diabetic patients and have increasingly adopted patient education and support functions. They represent the patient's first point of medical contact, they provide on-going diabetes care, and they are meant to treat the 'whole' person (Hunt, 1981). The general practitioner is the main source of patient referral to services available in the secondary sector and is therefore responsible to his/her patients for the proper mobilization of available resources.

Patients attend general practitioners on a State subsidized 'fee for service' basis. Diabetic patients do not automatically qualify for



chronic illness benefits entitling them to higher levels of subsidization. Most of the pharmaceutical costs involved in diabetes care (insulin, oral hypoglycaemic agents etc) are borne by the State. Patients are, however, expected to purchase some therapeutic aids such as that used in SMBG.

More than 90% of New Zealanders are under the care of a family doctor with whom they stay for a period of years (Burt and Cooper, 1983). The importance of continuity of care and the need for on-going contact with primary care physicians in diabetes, tends to reinforce the long term association between diabetic patients and individual doctors. Many diabetic individuals, especially the elderly, voice a marked reluctance to change doctors even when they are very dissatisfied with the service provided. There are marked variations in doctors' diabetic case-loads. Doctors, based on their recall of patients, identify between none and 100 diabetic patients in their practices (Beaven et al, 1975; Hay et al, 1979; Newman, 1987). The majority of general practitioners appear to provide diabetes care for fewer than 20 patients (includes both persons with IDDM and NIDDM). The number of patients reported by the doctors in their practices are substantially less than expected from epidemiological data.

Little data are available on attendance rates by diabetic individuals on general practitioner services. In Newman's study of NIDDM patients in Auckland, 10.4% of patients reported they attended their general practitioner more frequently than once a month, 46% greater than once every three months and 33% on a three monthly basis. The earlier study by Beaven et al (1975) also

indicated about half of the doctors brought their stable diabetic patients back to see them at three monthly intervals or less. Insulin-treated patients were seen more frequently. New Zealanders on average visit their doctor three to four times a year (Hyslop et al, 1983).

General practice and hospital-based services are distinct and separate organizational sectors in New Zealand's health system and this is also true for diabetes care. Contact is via patient referral and professional association. Public hospitals are the traditional centre-piece of New Zealand's health care system and have dominated the provision of diabetes services. Diabetic patients can be found in practically every hospital ward - medical, surgical, paediatric, eye, renal, cardiology. They are major users of both hospital inpatient and outpatient services.

This thesis focuses on use of public hospitals because most diabetes inpatient and ambulatory specialist diabetes services are provided within the public sector. What information is available indicates very few hospital admissions for diabetes have to date occurred within New Zealand's private hospital sector. Public hospitals have both the resources and clinical expertise, and are responsible for admitting acute cases which are not catered for by the private sector. In addition, persons with diabetes were in the past prevented from joining private medical insurance schemes through exclusionary clauses for pre-existing conditions, or heavy premium loadings. This effectively denied the majority of diabetic individuals choice of access to private care. By the mid-1980s, approximately 35% of New Zealand's population were covered by

private medical insurance, but the population is very segmented in terms of its participation (Chetwynd et al, 1983; PSA, 1985).

Hospital care is spatially and organizationally fragmented, and the hospital sector, as a whole, is characterized by a high degree of local autonomy in institutional provision. Public hospital resources are provided free-of-charge to patients, but with the exception of accident and emergency admissions, access to care is dependent upon referral processes. The regional character of diabetes services is determined by the administrative structure of hospital care and the availability of resources in a region.

Local hospital and area health boards are responsible for the provision of diabetes care at the secondary and tertiary levels. The allocation of resources to diabetes services is at the discretion of boards and local hospital management. Hospital administrators and decision-makers tend to pay very little attention to diabetes because diabetic inpatients are cared for by different specialists which masks the impact of diabetes on the system as a whole. Only diabetes outpatient clinics and diabetes extramural services are readily identifiable with the disorder. Official Department of Health guidelines for the provision of diabetes services by hospital boards were released for the first time in this year (Neal and Beaven, 1988).

The twenty-nine regional health authorities in New Zealand (comprising 25 existent Hospital Boards and 4 Area Health Boards) vary greatly in size and in area and population characteristics (see Chapter Seven and Eight). They have vastly different resource endowments, and therefore capacities for providing inpatient and

outpatient services to diabetic patients (see Chapter Eight). Area health boards may bring change in the effectiveness of regional hospital management and service provision. For the purposes of this thesis, and particularly in light of the time period the thesis covers, area health boards and hospital boards are regarded as one of the same and will be jointly referred to as hospital boards.

There are three main components of hospital-based diabetes services: inpatient care; diabetes (and other specialty) outpatient clinics; and hospital extramural or community-based diabetes education services. The service hierarchy is not unexpectedly most developed in the large urban-based teaching boards. Patients in the smaller rural and secondary boards are deprived of specialist care in many disciplines and may have to travel outside their board area to gain access to care (Department of Health, 1983).

Because of the structure of hospital care, diabetic patients will come under the care of many specialists - cardiologists, neurologists, obstetricians and gynaecologists, oncologists, ophthalmologists, orthopaedic and vascular surgeons, nephrologists and urologists for example. In many admission episodes, care may even be provided totally independently of consultation with a diabetes specialist. There are very few medical practitioners specializing in diabetes. In fact, there are fewer than 20 physicians across the country who have a specialty interest in diabetes (Neal and Beaven, 1988). Specialist diabetes care is provided by trained diabetes specialists (diabetologists), endocrinologists, physicians with a special interest in diabetes and paediatricians who are responsible for the care of diabetic children (usually up to the age of 12 years). There are no

full-time diabetes specialists as all practitioners have some general medical duties (Neal and Beaven, 1988).

Although the diabetic community places a great demand on hospital inpatient services, the diabetes outpatient clinic has been the traditional hub of diabetes services in New Zealand. The standard model of diabetes care suggests diabetic patients are acutely and routinely referred by their general practitioner to specialist diabetes services at appropriate times, with the understanding that patients are returned back to the family doctor with suitably documented policies for on-going follow-up and management in the primary care sector (Beaven et al, 1978; Scott 1981; Czyzyk, 1982; Beaven et al, 1983; WHO Study Group on Diabetes, 1985). The function of diabetes outpatient clinics is to provide, on an ambulatory basis, continuing but specialist periodic care for all aspects of diabetes treatment (excepting the need for hospitalization). Clinics provide: (1) outpatient stabilization of diabetes control; (2) specialist treatment of acute and problematic cases; (3) routine physical review, clinical and biochemical assessment; and (4) instigation, evaluation and adjustment of management plans and therapeutic regimes.

Less than half of the hospital boards offer diabetes outpatients services to their diabetic residents. Services tend to be concentrated in the large urban and secondary centres (Neal and Beaven, 1988; see Chapter Eight). Outpatient services are usually run as weekly diabetes clinics. These are staffed by diabetologists, endocrinologists or general physicians and registrars, with paramedical input from nurses, dietitians, laboratory staff and on occasions podiatrists. On average, 9.8 new diabetic patients are seen

per 100,000 head of population per month in New Zealand's diabetes outpatient clinics. A further 62.2 patients per 100,000 per month are seen as follow-up cases (Neal and Beaven, 1988). There is, however, considerable variation in case-load between regional clinics.

In all clinics, new patients are only seen on referral from general practice, as a direct consequence of hospital admission and on referral from hospital staff. Most clinics have waiting lists which vary anywhere between three weeks and six months, although urgent cases are seen immediately. Regular contact with IDDM patients is perceived to be important by specialist diabetes care providers with routine clinic follow-up typically occurring either on a three, six or twelve month basis. Care of the NIDDM patient is seen to lie more with the general practitioner but with specialist review annually or on referral from the family doctor.

Diabetic individuals also place considerable demand on other specialist resources, in particular, renal and ophthalmic services. Availability of these specialist facilities is again dependent on board size, and services are typically provided to diabetic patients via the clinics operated by the specialties concerned.

With the advent of patient education, diabetes outpatient services have expanded both in the clinic setting and through the development of hospital extramural services. In New Zealand, there was something of a general renaissance in community health care in the late-1970s. A body of health workers and community representatives saw the community as an alternative, and at times a better location for care than the traditional institutional setting

(Malcolm, 1983). Special funds were made available for the development of community health care projects when a levy was imposed on the sale of alcohol and tobacco in June 1977. "To qualify for funds, these projects had to: 'lessen the demand for hospital beds and inpatient services by promoting good health and preventing illness ... defer or obviate the need for hospital admissions ... assist in earlier discharges and rehabilitation in the community'" (*South Island Correspondents, Community Health Studies, 1980, p135*). This seemed very apt to diabetes.

Diabetes services tried to lock into this community care movement, benefiting directly from the resources newly made available and indirectly through the interest given to ambulatory care (Beaven et al, 1983). The re-organization of diabetes services centred on the de-emphasis of institutionalized forms of care, employment of diabetes nurse educators (nurses with special training in diabetes education and clinical management), the adoption of a multi-disciplinary team approach, and promotion of extramural patient education services.

Although diabetes outpatient clinics remain an entrenched part of hospital-based diabetes care, few resources have in practice been allocated to diabetes education. Re-organization towards community care has been slow with hospital boards tolerating rather than actively promoting development. The situation experienced in Canterbury in the early 1970s when community health initiatives were first being formulated is not atypical of boards' reactions throughout the late 1970s and early 1980s. "Considerable difficulty was experienced in appointing a diabetes educator with the prime

responsibility in teaching patients about their disorder since conceptually this had not been seen as the role of a hospital-based nurse. Moreover, lines of communication were seen to be difficult. Clearly at that time the diabetes educator represented a new and unusual hospital-based appointment" (Beaven et al, 1983).

Although the "beer and baccy" tax provided hospital boards extra funds to expand extramural services (Wright-St.Clair, 1983), whilst also providing the impetus for boards to consolidate and co-ordinate community health care in their areas, resources continued to be allocated increasingly to institutional services (Smith, 1981; Hyslop et al, 1983; Health Benefits Review, 1986). Hospital board members, hospital staff, Health Department and Treasury officials all expressed considerable concern over the "beer and baccy" tax which ultimately led to its incorporation into boards' block funding grants within only a couple of years after its introduction (Brash and Cutler, 1984). This allowed the funding and provision of community services to come directly under the jurisdiction of local board priorities in spending. Even though hospital boards do provide a range of primary care, early intervention and treatment services in the community, development of community care has been piecemeal and on limited resource budgets, and characterized by confused medical management. Community services are seen as an adjunct to primary hospital functions. With most boards facing major fiscal problems, development in the last few years has been stifled as attention concentrates on the traditional avenues of hospital expenditure. The moves into the philosophies of area health boards are supposed to facilitate greater community care - but will they?



Despite consensus of the philosophical approach to diabetes care described above, such systemic factors reflect in the disparate nature of resources given over to regional diabetes services. During the last ten years, many of the hospital boards have appointed diabetes nurse educators on full or part-time bases (17 boards had at least a half-time equivalent in 1986). Numbers of diabetes educators per capita are considerably lower than recommended levels (Neal and Beaven, 1988). Many of the nurses are located within the hospital setting and spend considerable time on inpatient teaching.

A multi-disciplinary team approach which integrates diabetes care providers into one unit is promoted strongly internationally as the basis of the delivery of diabetes care. The team ideally includes diabetes physicians, nurse educators, dietitians, clinical psychologists, social workers with additional input from other health professionals such as podiatrists, and exercise consultants. New Zealand has tried to emulate this (Scott, 1981), but with such small numbers and spatial concentration of resources, development of diabetes health care teams is very uneven and not well-defined. Any real expression of an integrated service can best be found in the cities of Auckland and Christchurch where community-based Diabetes Centres are located. From these centres, a variety of staff members provide a range of diabetes patient education services (Helm, 1980; Brown, 1981; Beaven et al, 1983).

However, even the resources of the large boards are fragmented and services dependent on part-time secondment of personnel, especially medical and dietetic input, from various parts of the hospital system. Although, diabetes clearly impacts on

psychological well-being and social functioning, no hospital board employs clinical psychologists or social workers specifically in diabetes care. Access to these services must be obtained through normal channels from already 'overloaded' hospital departments. In Christchurch, the local Diabetes Society in recognition of the urgent need for social support services, provides salary for a part-time field officer/social worker at the Diabetes Centre.

In many areas, the diabetes nurse educator has become the focal point of diabetes services. Although initially perceived as major diabetes resource centres and certainly well-staffed relative to most of the country (although not in absolute terms), the Diabetes Centres operating in Auckland and Christchurch really only serve as a model for community-based local specialist service provision. Access of 'out-of-town' patients to these centralized facilities is constrained by high local consumer demand and the distance and time needed to travel in order to gain access are a substantial barrier for many people. In the last few years, 'diabetes teams' from the main cities, have attempted to instigate 'out-reach' programmes in which they visit the under-serviced rural districts and townships.

Diabetes outpatient clinics and diabetes educational services are not well integrated, and although drawing on the same staff, are run more often than not as separate entities in different physical settings. Ambulatory clinical services remain within the walls of the hospital. Many community services, including diabetes extramural services, have found it difficult to function effectively under hospital administrations which are neither philosophically nor organizationally oriented to community health initiatives. Pressure

has been placed on programmes, not only to provide services acceptable to the institutional model, but also to establish and justify their existence (*South Island Correspondents, Community Health Studies, 1980*). It is not surprising hospital-based diabetes services lack cohesion and appear disjointed to both patients and care providers.

Diabetes educational services have developed on an *ad hoc* basis in New Zealand with no formal structure or standards. In contrast, in the United States there is official recognition and certification for both diabetes education programmes and diabetes nurse educators. Quality assurance mechanisms have been implemented and are enforced through the American Diabetes Association (ADA), the American Association of Diabetes Educators (AADE), the National Diabetes Advisory Board (NDAB) and the National Coalition for Recognition (NACOR) which conducts formal review and recognition of diabetes education programmes (National Steering Committee of NDAB, 1986; NDAB, 1986). New Zealand has been sadly lacking in the planning of diabetes services, training of health professionals and quality assurance of the care provided.

## **6.5 PROBLEMS IN THE DELIVERY OF DIABETES CARE**

Although the re-organization of diabetes care around diabetes patient education has produced various benefits as identified in Section 6.3.2., deficiencies in the provision of diabetes services have been exposed by the large number of persons with diabetes and their continued presentation of complications and early death. As Bajaj and Madan state, "It is a paradox of modern times that while we

understand more about diabetes and develop newer approaches to management, there is a palpable gap in the delivery of diabetes health care even to those in whom health education and simple remedial measures can be effective" (1982, p180). Problems arise both from the overall structure of the health care system which determines the allocation and distribution of health care resources to diabetes and their functioning within the health system, and from the organization and interaction of services specific to the local provision of diabetes care.

Many of the problematic features of the organization of diabetes care in New Zealand are not specific to diabetes. For example, "The promise that access to hospital services will be readily available on the basis of need has become increasingly discredited in New Zealand" (Health Benefits Review Committee, 1986, p79). Public hospitals are structurally dominant yet the public sector is inequitable in its allocation of resources and use of services, treatment may be ineffective, and the sector lacks consumer accountability. Although community based care seems appropriate to diabetes and most chronic disorders, it has been the hospital sector that has captured and maintained capital investment. New Zealand spends a larger proportion of public health expenditure on hospital services than most other OECD countries (Health Benefits Review, 1986).

Although areas lower down the urban hierarchy, may have higher supplies of hospital beds (Chapter Eight), they do not have the population thresholds, nor the infrastructure, needed for the provision of specialist hospital services, including medical personnel.

It is not surprising that diabetes services are most well developed in the large urban based hospital boards of Auckland and Christchurch.

In New Zealand, as in other Western countries, diabetes resources were from the outset superimposed upon traditional forms of health service provision. Typical of the organization of health services in these countries, new services were implemented without taking full cognizance of their organizational setting and community needs. Difficulties in diabetes care arising from the existent forms of health care fall into four areas: (1) deficiencies in diabetes health care modelling; (2) inadequacy of primary care; (3) problems of access and user selectivity of specialist services; and (4) practical difficulties with shared care (Beaven and Scott, 1987; Scott and Beaven, 1988; Beaven et al; 1988). These will be examined in turn.

**Diabetes Health Care Modelling:** Diabetes services in New Zealand have developed on an *ad hoc* basis without adequate knowledge of the epidemiological and individual characteristics of the diabetic population. Without a good understanding of the community profile of diabetes, health care programmes have not been rationally planned and applied in a cost and health effective manner (Home and Walford, 1984; Bajaj and Madan, 1986). Health services have generally failed to appreciate the large numbers of people involved, their demographic and socio-economic characteristics, their disease attributes and health requirements. Epidemiological models provide a framework for understanding diabetes on a population basis, for identifying health care problems and for improving intervention strategies (Herman et al, 1984; Connell, 1985; Bajaj and Madan, 1986). Limitations and deficiencies

in data collection methods pose difficulty in the planning and implementation of diabetes services (Melton et al, 1984; Herman et al, 1984; Rothenberg et al, 1985). A population database is developed in this thesis to examine the impact of the organization of diabetes care on local hospitalization patterns. It would appear from recent literature (Kaplan and Davis, 1986; Beaven and Scott, 1986; Dunn and Turtle, 1987; Scott and Beaven, 1988) that diabetes education programmes, as they have developed to date, have often not been totally convincing in showing long term benefits with respect to both health outcomes and resource use. In their critique of evaluative studies of patient education, Kaplan and Davis (1986) cited a number of methodological problems relating to study designs (e.g. using patients as their own controls rather than randomization, small and potentially biased samples, length of patient follow-up), deficiencies in cost accounting and analytical procedures, problems with attrition of patients from programmes and inadequate documentation of programme costs. These factors necessitate caution in endorsing some of the claims made with respect to patient education.

Rettig and colleagues (1986) for example, state that without using a randomized control-trial group format in their study, they would have erroneously attributed reduction in hospitalization to the diabetes education programme provided. They concluded that the important event contributing to the observed reduction in hospital admission was the overall restructuring of their system. Changes in the educational approach constituted but one of the modifications made to their diabetes care programme.

Two frequently quoted studies on the efficiency of diabetes education programmes in reducing diabetes hospitalization are the Newcastle, Australia (Moffitt et al, 1979) and Grady Memorial Hospital, Los Angeles (Miller et al, 1972) studies. Both, however, achieved marked changes in admission rates through re-organizing their systems of delivering diabetes care. They introduced, for example, telephone counselling and ambulatory outpatient services, and imposed greater medical control over patient access to services. Whitehouse et al (1983) also saved hospital bed days by offering patients outpatient stabilization and regulation of their diabetes control via a hospital oriented day-care unit rather than on an inpatient basis.

Thus, patient pathways to care changed through a service re-orientation towards ambulatory care. As a consequence, fewer patients were being admitted into the hospital wards. Patient education per se played a minor role in the observed reductions in hospital use. Education is but one component in the provision of diabetes care. It is salutary to examine the role of diabetes education within the context of the overall structure and organization of diabetes health services.

Basic principles of diabetes management strongly suggest diabetes health care should be re-organized away from the hospital sector towards treatment in the home and in the community. An appropriate foundation for the delivery of diabetes care is the model of health care first promulgated at Alma Ata which emphasizes the provision of promotive, preventive, curative and rehabilitative services in the community (WHO, 1978; Alberti, 1980; Bajaj, 1980).

However, the delivery of health care in capitalist and in many of the socialist countries is already well established in highly structured and service differentiated systems. Despite a similar advocacy for community-based care, major service re-organization is unlikely to occur in the near future because of the dominance of hospital and specialist-based care and the development and power of the medical-industrial complex.

Improvements in the provision of diabetes services, in countries like New Zealand, most practically centre around both effective introduction of new services and programmes, and better integration and co-ordination of primary, secondary and tertiary services already existent within the health system. In the United States, the Center for Disease Control (CDC) recently introduced, on sound epidemiological bases, a number of specific diabetes control programmes. Individual programmes were implemented at the primary care level. The ability of the programmes to influence patient outcomes was seen to depend on: (1) the integrity of the primary care sector and its ability to respond to patient needs through the provision of care from multiple providers; and (2) the degree to which community resources could be integrated into the total health care system to allow patient access to care (Scott and Beaven, 1988). Barriers to the implementation of nationwide diabetes programmes have also been identified by Rosenqvist and colleagues (1986). They state reformation of diabetes care meets with resistance to change and in order to minimize this resistance, organizational change must start with staff at the grass roots level. They found health care providers lacked knowledge in diabetology,



there was a lack of staff co-operation, a lack of guidelines for diabetes care, and a lack of co-operation with specialists.

**Inadequacies in Primary Care:** Like the secondary sector, there is wide spatial variation in the availability and utilization of primary care services in New Zealand (Barnett and Sheerin, 1978; Sheerin and Barnett, 1980; Malcolm et al, 1980; Davis, 1981; Barnett, 1988). The degree to which general practitioners are physically, financially and socially accessible to potential users is fundamental to whether or not diabetic individuals will receive appropriate care. Although patterns of diabetes care in general practice have not been extensively researched, various studies indicate effective diabetes management protocols are lacking in primary care, and that standards of care and follow-up are often gravely deficient (Doney, 1976; Kratby, 1977; Hayes and Harries, 1984).

Newman (1987) for example, in his study of general practitioner care of NIDDM patients in Auckland concluded that the study doctors had relatively poor knowledge of diabetes and management practices. Just under half of the doctors aimed for goals of glycaemic control which were considered acceptable by a panel of local diabetes specialists. Only 20% of the 120 NIDDM patients in the survey were found to have physiological control. Better metabolic control was observed in the patients of those doctors who aimed for tighter control in their patients.

Reasons for deficiencies in diabetes care at the primary care level include the time and resources required to provide adequate diabetes treatment and education for the patient. Doctors must also

have the essential skills and interest in handling what has become an increasingly sophisticated and complex area of care. Some general practitioners are, however, deficient in their knowledge and management of diabetes, they lack confidence in treating certain types of patients, they do not perform routine clinical procedures, and underutilize available technology and support services (Beaven et al, 1975; Doney, 1976; Kratby, 1977).

In addition, most general practitioners are unable to identify their diabetic case-load. Difficulties in diabetes management arise through deficiencies in patient follow-up and incomplete medical surveillance. Hayes and Harries (1984) report that the lack of adequate automatic recall systems available to general practitioners contributed to a breakdown in health care standards when the responsibility for continued care was transferred from hospital clinics to general practice. They found general practitioner follow-up to be gravely deficient with only 13.6% of patients receiving full medical review at least once a year.

Systematic review of patients is seen as a practical way of overcoming some of the problems currently faced by general practitioners in providing on-going diabetes care (Home and Walford, 1984; Hayes and Harries, 1984). Relatively simple computer-based patient identification and recall systems have been established in some general practices abroad as well as in New Zealand to: (1) encourage patients to return regularly to see their general practitioner and not to 'drop-out' from medical follow-up and health maintenance practices; and (2) to improve the actual detection and surveillance by general practitioners of diabetes complications and

the identification of deteriorating and poor metabolic control in their patients (Reith, 1985; Gibbins et al, 1986).

Protocols for diabetes management in primary care have been developed. These incorporate expert-defined guidelines that can practically be undertaken within general practice. Treatment protocols may be of particular importance for general practitioners who come in contact with very few patients and so are unfamiliar with the disorder and appropriate forms of management. Gibbins and co-workers (1986) examined the outcomes of a simple patient recall-review system implemented in general practice. They report that at the 21 month review only 4 of 171 patients on the general practice register defaulted from attending for review. Only 35% of patients had blood pressure checks and 29% eye examinations performed before the system was introduced, but these had increased to 80% and 81% respectively by the end of the 21 month period.

**Selective Caseloads:** Restrictive and selective case-loads of specialist ambulatory diabetes services is the third area of concern in the organization of diabetes care. Although differences will exist in user groups because of the nature of the services being provided, it is apparent that diabetic individuals with like need are being denied access to some facilities. It has been estimated that attendance on outpatient education services is as low as 3-4% of the known diabetes population in some communities and seldom more than 25-30% in others (Chapko et al, 1987; Beaven et al, 1988).

In Rochester (USA), for example, only 20% of all known diabetic patients attended diabetes or endocrine clinics (Melton et al, 1984). Green and Solander (1984) similarly report in Denmark that only 26% of prevalent cases used specialist services. This attendance level decreased to only 18% among elderly patients (age  $\geq$  70 years) and although increasing for children, still only reached 74% in children aged 0-9 years. Green and Solander also state "Within all age groups the proportion was higher among patients residing in areas possessing a hospital with a department of internal medicine compared with patients residing in rural areas" (1984, p196). Fishbein and colleagues (1982) report their experience in Rhode Island. They found that despite a 10 year mean duration of diabetes, only a third of hospitalized diabetic persons with age less than 30 years had received more than two hours of outpatient diabetes education.

Utilization rates are affected by factors traditionally associated with service inaccessibility (e.g. lack of patient awareness of services, financial problems, locational factors, language barriers, waiting times, service schedules). However, significant barriers to care also relate to the health care organization, particularly the lack of physician awareness of services, the lack of or bias in patient referral and limitations imposed on entry of patients into programmes (Brown, 1981; Chapko et al, 1987).

In Christchurch for example, Scott and colleagues (1985) documented that hospital-based staff referred few patients who had been hospitalized to diabetes education services available from the same health authority. "Even in the younger patients admitted with

diabetic ketoacidosis, the opportunity for education was extended to less than half. In individuals > 60 yr, only 10% of patients were offered education, although this group was most frequently admitted to hospital"(Scott et al, 1985, p47). In a retrospective study of diabetic patients who underwent amputation of the lower limb in Christchurch hospitals, only 28% were subsequently referred to diabetes education (Beaven et al, 1988). This is surprising since it has been suggested that diabetes education strategies are highly effective in reducing hospitalization from complications of foot amputations and ketoacidosis (section 6.2.3). Delivery of diabetes care appears not to be well co-ordinated even within small areas.

Ambulatory diabetes services, like many other health facilities, provide care for a minority of affected individuals. Service user-groups do not necessarily include those at most risk or those who are suffering from complications. Diabetic individuals who are perhaps less likely to benefit from diabetes specialist services, for example those who are highly motivated, are often those who most frequently attend. Patient 'drop-out' of programmes is also another important factor especially since the characteristics of these individuals and their long term prognosis are not usually known. However, issues of consumer dissatisfaction, suitability of service content, and individualization of programmes have received little attention from diabetes care providers. Bias in referral patterns and organizational interaction result not only in a distortion in the clinical spectrum of diabetes observed in different portions of the medical system (Bender et al, 1983; Melton et al, 1984; Rothenberg et al, 1985) but also patient discrimination on grounds other than need. User-groups differ in epidemiological, clinical, socio-economic, and

demographic characteristics. Diabetes services even if highly effective, may have only a minimal impact on the diabetic health problem in the community as a net result of fragmentation in service provision and inequitable patient access.

**Difficulties with Shared Care:** Various studies report that better diabetes control is achieved through patient management in the specialist clinic setting than through primary care (Basdevant et al, 1982; Dornan et al, 1983; Hayes and Harries, 1984). Others have reported that general practitioners providing diabetes care on an organized basis can achieve the same degree of control as that reached by hospital clinics (Ruben et al, 1982; Singh et al, 1984). Diabetes care has long been advocated as a joint responsibility but the practicalities of shared care have not been well expressed in service organization. Receipt of care has been inhibited by inappropriate referral, lack of referral, poor communication between services and lack of co-ordination of service provision. The large numbers of diabetic persons in the community now make it logistically difficult to continue to structure diabetes care around underfunded overworked diabetes outpatient clinics. Many activities provided in specialist clinics can be translated into the primary care sector if the knowledge and resources are made available to general practitioners.

The concept of structured shared care has been implemented in several areas in Britain in the attempt to improve patient surveillance and the provision of effective diabetes care. In Poole for example, a community care service was established between the hospital diabetic clinic, the hospital laboratory service, and family practitioners where by the responsibilities of each service were

clearly defined (Hill, 1976). This is not unlike the set-ups reported in Canterbury (Beaven et al, 1978) and in Ipswich in Suffolk (Day et al, 1987). In Poole, computer records ensure minimal but appropriate surveillance is maintained within the hospital and the records shared between the clinic and family doctor to ensure diabetic care is neither lacking or duplicated. Although this scheme appears to have been successfully implemented with beneficial outcomes, the overall results of the Ipswich programme were disappointing. Standards of diabetes care were inadequate for those patients who were reviewed by their general practitioner (Day et al, 1987) .

Shared management of patients is not new but if it is to be effective clinically as well as being cost-efficient then there must be good liaison and full co-operation between the parties involved. The shared care scheme established in Stirling in Central Scotland is based on a computerized patient recall system. This enables every patient in the scheme to be monitored on a regular basis in an appropriate setting, provides mechanisms for identifying defaulters, that is patients who drop out from regular follow-up, and permits both hospital and general practitioners easy access to joint patient records (Reith, 1985).

Although debate continues as to who is responsible for the provision of diabetes care, the fundamental issue remains that the structure of services available to diabetic patients should translate into effective care to all those affected by the disorder leading to both reduced morbidity and mortality.

## 6.6 CONCLUSION

Patient education infiltrated diabetes care because health outcomes of patients were less than satisfactory under traditional medical management and because the disorder intrinsically lends itself to behavioural modification and individual patient responsibility for its day-to-day management. Although it has not always been recognized as such, diabetes is justifiably termed a major public health problem. A good understanding of the nature of the health disorder to which health care is directed is essential if appropriate services are to be delivered.

The aetiology of diabetes is such that life style approaches to prevention and care are now widely advocated and accepted as an integral part of modern diabetes management. Improved glycaemic control and maintenance of near normal metabolic processes improve the life chances of diabetic persons and reduce their risk to the development of diabetic complications. The pathological and physiological processes involved in diabetes underly the therapeutic efforts to achieve the aims of diabetes care in minimizing the health and social consequences of the disorder. Diabetes is an exemplary model of health care for chronic disorders. Diabetes care is philosophically based on community care, adoption of self-care principles and behaviour modification in patients. Diabetes according to the Presidential Task Force for health care in the United States is the most winnable of the big three disorders (heart disease and strokes, cancer and diabetes).



Despite the merits of the modern approach to diabetes management, the practical expression of this philosophy in terms of the provision and organization of services is problematic. In New Zealand, as elsewhere, diabetes services are provided within the framework of the national health care system. Diabetes care is subject to its ideological and organizational machinations and individuals with diabetes to the inequities present in the system. It is not surprising that the full potential offered by patient education is not realized in practice.

Diabetes education was from the outset superimposed upon the existing health service structure. Diabetes patient education which stresses self-help and individual responsibility in health maintenance reinforces the ideological reaction against collectivism present in New Zealand's health system today. The provision of diabetes care has been re-organized around patient education but services are still dominated by the clinical model and controlled through the hospital sector. Like the system as a whole, the delivery of diabetes care is organizationally fragmented, hierarchically structured, and characterized by physical, financial, social and organizational inaccessibility. There is considerable spatial variability in the availability of primary care resources, specialist ambulatory diabetes services and inpatient hospital care.

Allocative and organizational problems in the delivery of health care reflect in inappropriate and excessive utilization of health services by some individuals whilst denying others access to needed care. Resource allocation should be based on need criteria that reflect community health status but which are independent of supply.

The following chapters will examine the extent to which supply and organizational factors impact on hospitalization for diabetes.

It is clear from the discussion presented in this chapter that there are major problems with the organization of diabetes services as evidenced by service inaccessibility, unnecessary hospitalization and poor health outcomes. Given the current fragmented nature of diabetes service provision, it is perhaps inappropriate to expect educational facilities to result in major health advantages for those people afflicted with diabetes in the community, and as a consequence, reduction in health costs from diminished hospitalization.

The restructuring of any service for chronic disorders such as diabetes must accommodate the critical roles of the primary health care sector, education components, hospital inpatient and outpatient services. Diabetes education is very important but recognition must be given to organizational and spatial aspects of service provision. Reductions observed in rates of hospitalization overseas have been as much a function of service restructuring than intensification of patient education. Classical barriers which exist between the primary and hospital sector need to disappear otherwise bias in referral patterns will continue to inhibit effective diabetes management.

In recognition of the deficiencies of diabetes care in New Zealand, health professionals in association with the Department of Health formulated guidelines for diabetes services within hospitals and also for epidemiological and resource requirements and allocation (Neal and Beaven, 1988). At the same time the Medical

Research Council of New Zealand has categorized diabetes as a health priority for New Zealand. Fundamental deficiencies and problems in provision of care will not be overcome unless effective health services research is undertaken and health service planning is cognizant of the demographic, epidemiological characteristics and needs of the diabetic population. It is to these issues that attention now turns.

## CHAPTER SEVEN

# TEMPORAL AND SPATIAL VARIATIONS IN HOSPITALIZATION FOR DIABETES

### 7.1 INTRODUCTION

Hospital utilization rates are known to vary widely between areas. As Rothberg states:

"Whether one defines region as a city, a county, a state, a census division, or a standard metropolitan statistical area (SMSA) is of little consequence; hospital use rates still vary significantly, even when comparing like diagnostic admissions among like groups" (1982, p1).

Spatial variation in social phenomena are of intrinsic interest to geographers but in recent years two factors have heightened the significance of and interest shown in area variations in rates of hospital utilization. First, all countries have been forced to re-appraise their expenditure on health care. Hospital services are very expensive to provide and cost-containment policies have been enforced in both state and privatized health systems. Area variations in rates of hospitalization have come under scrutiny with the pursuit of more efficient use of resources. There is major potential for cost-savings if high admission rates and prolonged length of stay are indicative of excessive and unnecessary hospitalization.

Second, there is growing concern over inequities in the quality and type of care available to different communities. Area variations have strong implications for the quality of medical care since some areas may have high levels of hospitalization simply because primary and ambulatory services are inadequate through their unavailability and/or poor quality. Discussion presented in Chapter Six indicated many diabetes-related admissions to hospital are associated with inadequate use of ambulatory health services. Many hospitalization events are potentially preventable through appropriate provision and use of primary and ambulatory specialist services and early intervention in the community. In addition, heightened "consumer-consciousness" means more and more people are questioning the quality and role of hospital based care. People are aware that hospitalization is not free of iatrogenic risk, that increased hospital use increases the likelihood of harm, and that there are often alternative, and perhaps, better forms of care available.

Spatial variations in rates of hospital use are described in the literature at a variety of geographical scales and for a variety of situations. The theories and approaches taken to explain hospitalization patterns and the explanatory argument forwarded in this thesis, have been discussed in detail. The aim of this and the following four empirical chapters is to investigate organizational influences on diabetes related hospitalization.

Use of health services by diabetic persons has not been extensively researched. Although the advent of diabetes patient education stimulated interest, the volume of literature on diabetes-related hospitalization and health services research is still small.

Recent studies have provided urgently needed information but vast gaps in knowledge remain. The research presented in this thesis pioneers applied diabetes research in New Zealand. The function of the empirical work is not only to apply the conceptual framework advanced in the earlier chapters, but also to identify and measure diabetes-related hospitalization in New Zealand. The aims and methods used in this and the following four chapters are governed by this dual research purpose and reflect the innovative nature of this type of this study.

The empirical investigation of diabetes related hospitalization is divided into two parts reflecting the two basic aims of the thesis. Chapters Seven and Eight are set at the macro-level and examine hospitalization in relation to the diagnostic classification of Diabetes Mellitus. They aim to test the applicability of Roemer's Law to diabetes hospitalization. As Chapter Seven is the first of the empirical chapters, its objective is primarily to set the overall context by identifying temporal and spatial trends in rates of hospital use for diabetes.

Chapter Eight more specifically examines the relationship between the supply of resources and the area variations in diabetes hospitalization identified in Chapter Seven. Are per capita rates of diabetes admission and bed occupancy positively related to an area's hospital bed supply? Does the availability of doctors, both general practitioners and hospital-based specialists influence admission patterns? Or are regional variations due to legitimate differences in the needs of the area populations?

The macro-scale analysis provides a suitable forum to investigate the effects of resource availability on hospital utilization. Small area analysis is a technique which identifies area populations on the basis of patterns of use of services and is a useful method for examining variations in hospitalization (Wennberg et al, 1982). The regional study does not, however, facilitate an in-depth analysis of the relationship between patterns of hospitalization of diabetic persons, individual access to services and local organization of diabetes care. An analysis is, therefore, undertaken at the microscale. This second part of the research (Chapters Nine to Eleven) extends the investigation by considering patterns of hospitalization for a local diabetic population. In particular, a case study of the Insulin-treated Diabetic Population of the Canterbury Hospital Board Area is presented, and patterns of hospitalization at the level of the individual and local health care organization examined.

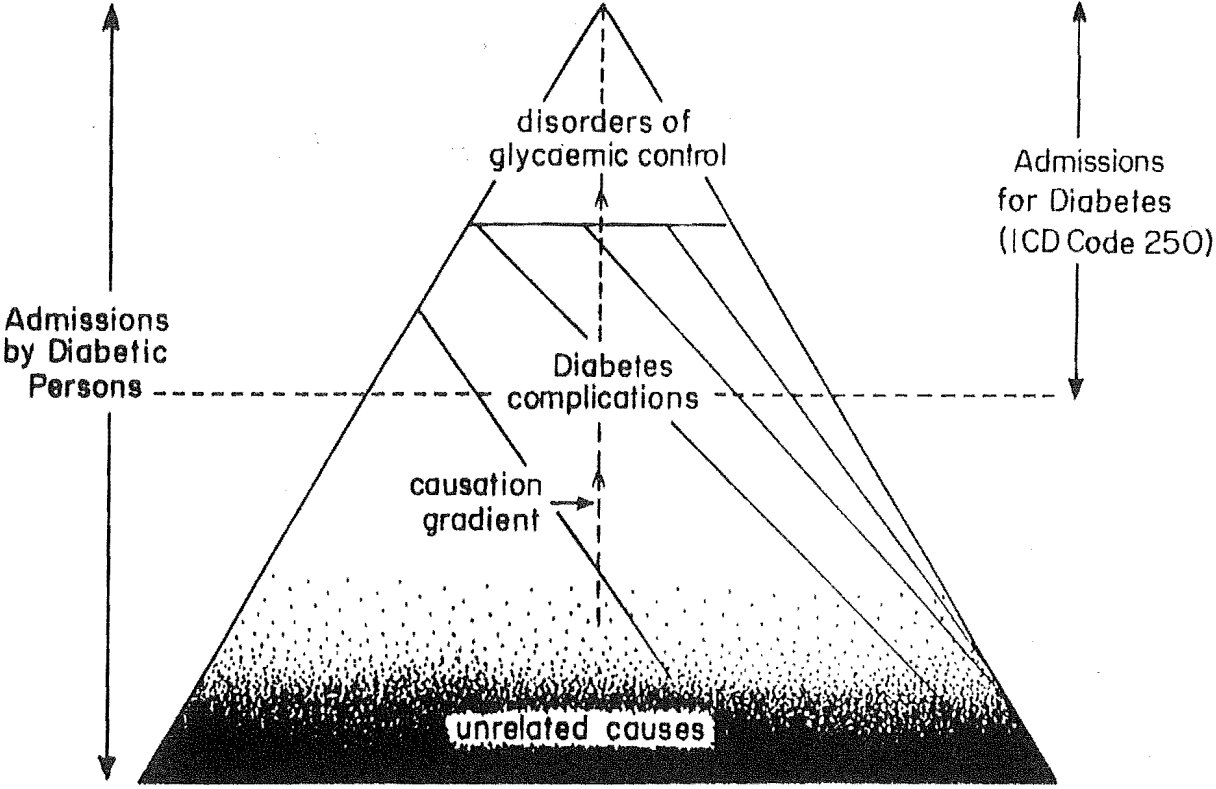
It is worthwhile to study both levels of aggregation since the investigations serve to answer different questions but are complementary in their overall aim of examining the effects of the health care system on diabetes related hospitalization. Measurement of diabetes related hospitalization is, however, problematic. A methodology for investigating this topic was therefore developed and is described in Section 7.2. As indicated above, the specific objectives of this chapter are: first to review national trends in hospitalization for diabetes in New Zealand over the last twenty-five years; and second, to identify and describe regional variations in diabetes hospital use.

## 7.2 A METHODOLOGY FOR MEASURING DIABETES RELATED HOSPITALIZATION

There are methodological problems in quantifying levels of diabetes related hospitalization: it is difficult to identify all hospital admissions that involve diabetes, and it is hard to determine the extent to which diabetes precipitated hospitalization. As discussed in Chapter Five, diabetes is associated with a number of complications. These tend to be preferentially identified as admission diagnoses or causes of death with or without mention of diabetes as a contributory factor. In some cases it is quite apparent that diabetes is the primary cause of hospitalization, in others there seems to be no relation whatsoever, but, and perhaps, in the largest proportion of admissions, the role played by diabetes is unclear. Take, for example, a diabetic person who is hospitalized after a myocardial infarction. What part did their diabetes play in precipitating the cardiac event?

Measurement of diabetes related hospitalization can be conceptualized in two ways. These are presented in Figure 7.1. One examines *admissions by persons with diabetes* and the other *admissions for diabetes*. The first is a population approach and represents the whole pyramid. It identifies all hospitalization events involving people with diabetes irrespective of the cause(s) of admission. This includes a number of admissions for causes seemingly "unrelated" to diabetes, for example, trauma, malignancies, fractures, elective surgery etc. However, in many of these events a dissociation between diabetes and the cause of admission cannot be established. "Unrelated" admissions can be regarded as comprising the base of the pyramid, lying at one end of a causation gradient in





**Figure 7.1:** Measurement of Diabetes Related Hospitalization.

which diabetes becomes increasingly implicated in the need for hospitalization. This population based approach to measuring hospitalization is used in the microscale analysis, and will be discussed further in Chapters Nine to Eleven.

In contrast, statistics officially collected by the New Zealand Department of Health, via admission and discharge recording systems (A & D system) operated by local hospitals, relate to disease entities. Hospitals in New Zealand like those overseas, categorize admissions (reported as discharges and deaths) according to the WHO International Classification of Diseases (ICD). Only those admissions which are identified and annotated on patient medical records as being caused by diabetes are counted under this approach, that is, hospital utilization is officially documented and interpreted for the disease entity of diabetes. Although secondary (B, C or D) diagnoses are collected, only data for primary (A) diagnoses are published and reported in national health statistics.

The only information available in New Zealand on diabetes from which temporal and regional variations in hospitalization patterns can be examined, is this national hospital and selected morbidity data. Data used in this and Chapter Eight, therefore, pertain to hospitalization events where the ICD Code 250.0-250.9 *Diabetes Mellitus* is listed on the discharge sheet as the principal diagnosis, X i.e. the condition established as the primary cause of hospital admissions (the smaller aspect of the pyramid).

The main methodological concern is the accuracy at which the A & D system reports diabetes related hospitalization. As Figure 7.1

and Appendix C.1 indicate, a number of diabetic conditions are contained within the ICD code 250 (Appendix C.1 gives a tabular listing of the ICD diabetes classification). Although identifying disorders of glycaemic control, the A & D system detects varying proportions of admissions involving the complications of diabetes. Many of these conditions go unrecognized, have uncertain manifestations and are liable to be recorded under a variety of ICD codes. A bench mark was needed against which the data derived from the national A & D system, hence the data used in the national and regional trends, could be interpreted. Discharges with diabetes as the primary diagnosis from two large hospitals in Christchurch were, therefore, calibrated against data obtained from an independent audit of admission by diabetic persons to these hospitals. This latter study undertaken by the author and colleagues (Brown, Scott and Beaven, 1985), will not be discussed except in relation to the present topic.

Comparison of the results obtained through the hospital audit and ICD A & D system is provided in Table 7.1. The data relate respectively to all discharges from the Christchurch and Princess Margaret Hospitals during the 12 months of 1983 of diabetic persons resident in the Canterbury Hospital Board Area, and all discharges retrieved through the hospitals' computerized A & D system with the ICD Code of 250 as the primary diagnosis for the same year and patient domiciliary area. The audit data represents the total area of the hospitalization pyramid (Figure 7.1) and the A & D data the upper portion. Overall, hospital admissions for diabetes accounted for 29% of all the admissions by diabetic persons to these two hospitals and 22% of their total days stay. The detection rate of the A & D system

**TABLE 7.1**  
**COMPARISON OF HOSPITALIZATION DATABASES**

**(a) Audit Data (by diabetic persons)**

<b>Hospital</b>	<b>Number of Discharges</b>	<b>Total Days Stay</b>	<b>ALOS<sup>1</sup></b>
Christchurch (Beds = 482)	388	6440	16.6
Princess Margaret (Beds = 336)	403	8705	21.6
Total	791	15145	19.1

**(b) A & D Data (ICD A Code = 250 Diabetes)**

<b>Hospital</b>	<b>Number of Discharges<sup>2</sup></b>	<b>Total Days Stay</b>	<b>ALOS<sup>1</sup></b>
Christchurch (Beds = 482)	130 (34)	1637 (25)	12.6 (76)
Princess Margaret (Beds = 336)	99 (25)	1690 (19)	17.1 (79)
Total	229 (29)	3327 (22)	14.5 (76)

(1) Average Length of Stay

(2) ICD Data as Percentage of Audit Data.

was higher at Christchurch Hospital than at the Princess Margaret Hospital. This reflects the effects of differences in case mix between the two hospitals and the efficiency of the medical staffs and medical records departments in identifying diabetes as a cause of admission. It is assumed that with both the aggregation of data and examination on the basis of patient domicile rather than by admitting hospital, that variability in data retrieval between hospitals, will average out, and thus, not significantly bias the results of the investigation.

Because the categorization of the causes of admission were not totally compatible between the audit and A & D data, the exact proportion of admissions identified by the A & D system for the various complications of diabetes (Appendix C.1) could not be determined. In general, however, the cross-referencing of data indicated that admissions involving disorders of glycaemic control and diabetes with ophthalmic manifestations were best detected. Despite the overt nature of diabetes nephropathy, less than 20% of the "renal admissions" in the audit data were identified under the renal code 250.3. Vascular complications were infrequently recorded under the 250 code.

The recording of hypoglycaemia (low blood sugars) is also problematic since provision is made for this disorder under the ICD Code 251 (other disorders of pancreatic internal secretion). However, the A & D data from both hospitals indicated that the majority of admissions identified in the audit study as being precipitated by hypoglycaemia were actually assigned a primary code of 250 with secondary diagnosis of 251. Since hypoglycaemia, although being important in terms of diabetes morbidity, contributes

as a primary cause to a relatively small proportion of total admissions (2% in the audit data) and many of these admissions are included in the 250 code, the error from this coding problem in the data used in the chapter would be small. It is also assumed that this error is uniform throughout the country.

### **7.3 NATIONAL TRENDS IN HOSPITALIZATION FOR DIABETES**

In the past, health outcomes of diabetic person were poor relative to the general population and considerable demand was placed on hospital inpatient resources. Individuals with diabetes seemingly occupied disproportionate numbers of hospital beds. However, much has changed in the last twenty five years. While new drugs and therapeutic aids have been developed, and diabetes treatment regimes altered, New Zealanders, as a population, have placed increasing demand on hospital services. It is generally assumed that the quality of diabetes care has improved and that the life chances of persons with diabetes are much enhanced, but rates of hospitalization have not necessarily decreased.

This section briefly examines historical trends in national rates of hospital use for diabetes both in terms of hospital discharge and length of stay. This provides a background to the regional and local analyses to follow.

### 7.3.1 Data Sources

Annual discharge statistics for all causes of admission to hospital and for the principal diagnosis ICD Code 250, Diabetes Mellitus, were obtained for all public general hospitals in New Zealand for the 25 year period 1961-1985 inclusive. All data were extracted from the National Health Statistic Centre's (NHSC) annual publication series on medical statistics, and hospital and selected morbidity data, and from NHSC's publications on trends in health and health services. All figures represent discharges from hospital, including deaths in hospital. These figures include re-admission episodes which are counted as individual admission events. While the data officially pertain to discharges, they may for ease of discussion be referred to as admissions.

Data was collected on discharges, total patient days and average length of stay (ALOS). Per capita rates of hospitalization were extracted directly or calculated using estimated mean population totals. Rates are expressed either per 100,000 mean population or per 1,000 population depending on the measure in question. Note hospitalization rates are determined using the general population as the population denominator. Use is, thus, measured for the population as a whole, and not specifically for the diabetic population.

Data was broken down by sex and age. Information was collected for all years with the exception 1975, 1976 and 1977. While ethnicity is an important factor in diabetes epidemiology, and in individual utilization behaviour, data by ethnic breakdown was reported infrequently.

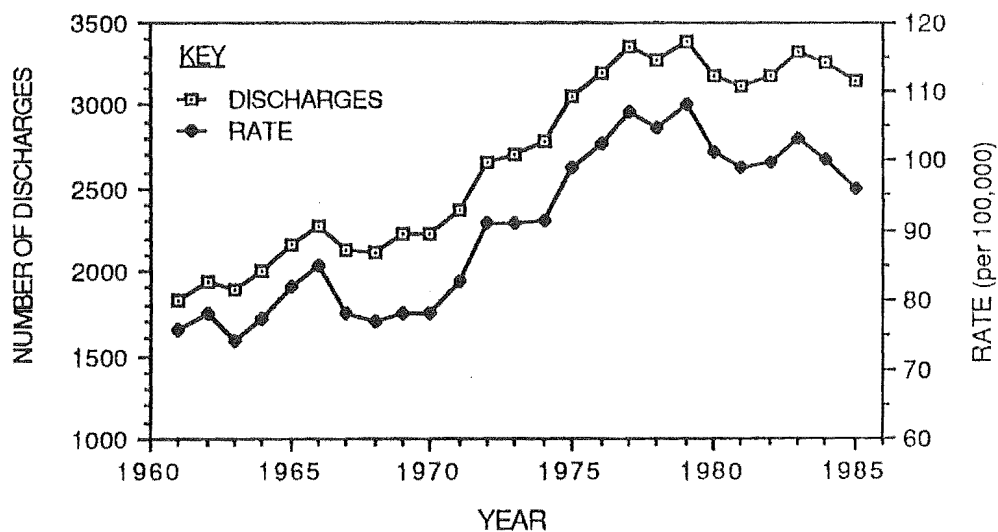
### 7.3.2 Temporal Variations in Diabetes Hospitalization

**Discharges:** Levels of hospitalization for diabetes have increased both absolutely and relatively. The number of discharges recorded annually, and rates of discharge per capita, have risen over time (Figure 7.2). Even though there is cyclical fluctuation in hospital use, discharge rates climbed from 75.5 per 100,000 (1833 discharges) in 1961 to 108.2 (2281) in 1979. The 1980s appear to be characterized by a stabilization of hospital admission around 100 discharges per 100,000 persons. This was a period in which diabetes patient education initiatives were introduced into diabetes care, and use of hospital services, in general, came under increasing scrutiny.

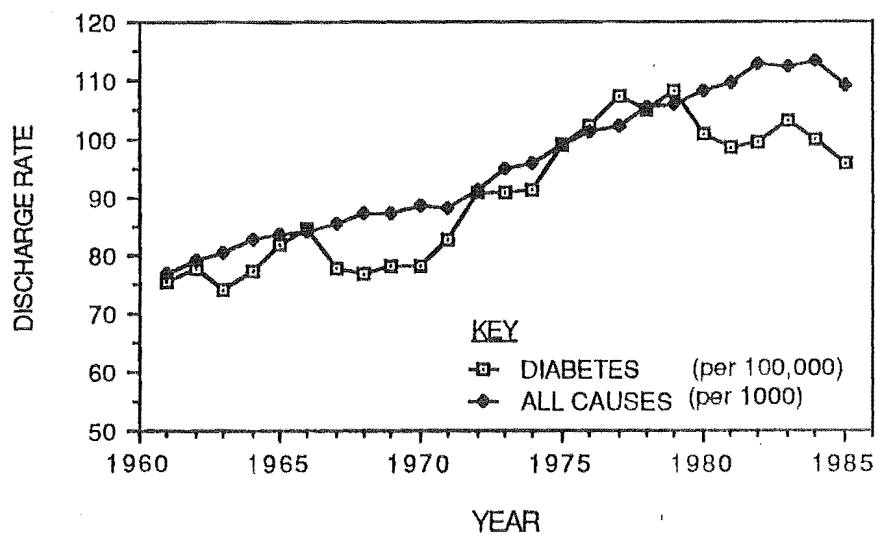
The trend in the diabetes discharge rate strongly parallels per capita admission to hospital from all causes ( $r = 0.90$ ) (Figure 7.3). Over the last twenty five years, the total number of discharges from New Zealand public hospitals have increased on average by 159 per 100,000 population per annum, and diabetes admissions 1.36 per 100,000. Thus, it would appear that increasing trends in hospital use for diabetes reflect more general trends in New Zealand's per capita use of hospital services. New Zealanders have made greater use of increased resource availability in the hospital sector.

The increase in hospital use for diabetes observed up to the 1980s is largely attributable to a dramatic increase in discharges for males (Figure 7.4 and 7.5). In the 10 year period 1968-1978 the per capita rate of hospital discharge for diabetes for males rose by 73%

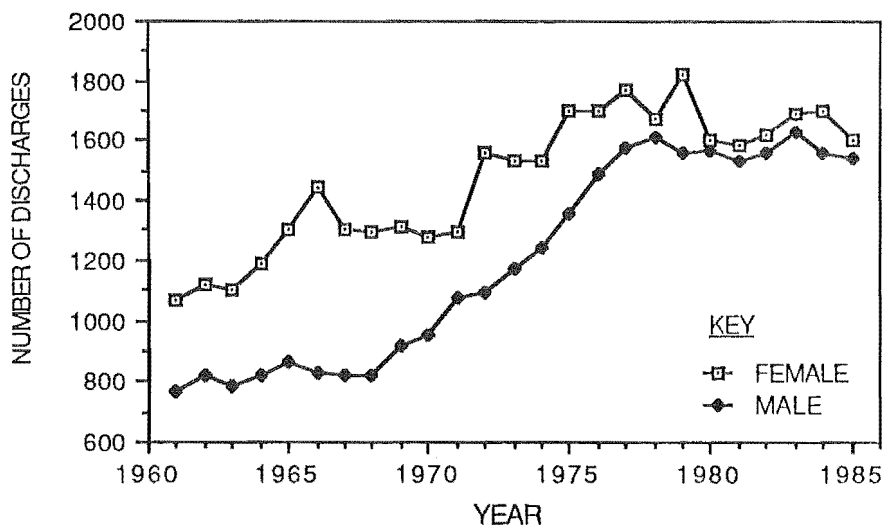




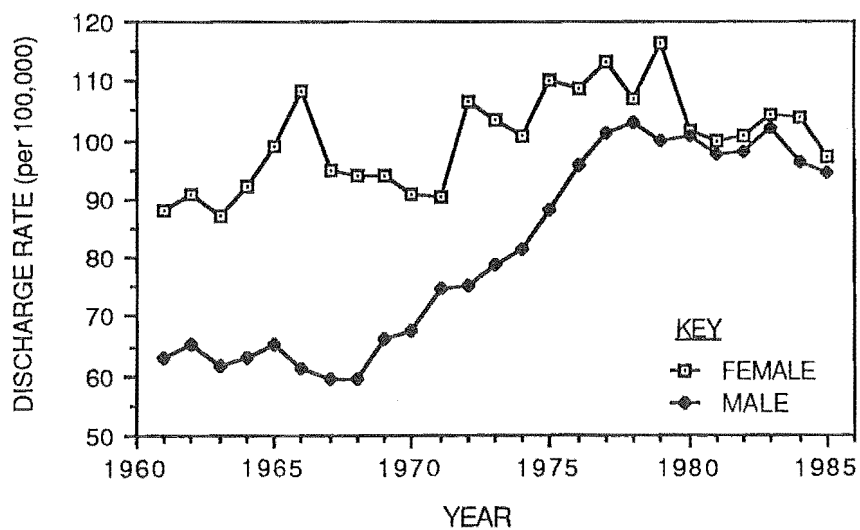
**Figure 7.2:** Trends in Hospitalization for Diabetes 1961-1985.



**Figure 7.3:** Comparison in Time Trends Between Diabetes and all Causes of Admission.



**Figure 7.4:** Discharges by Sex.

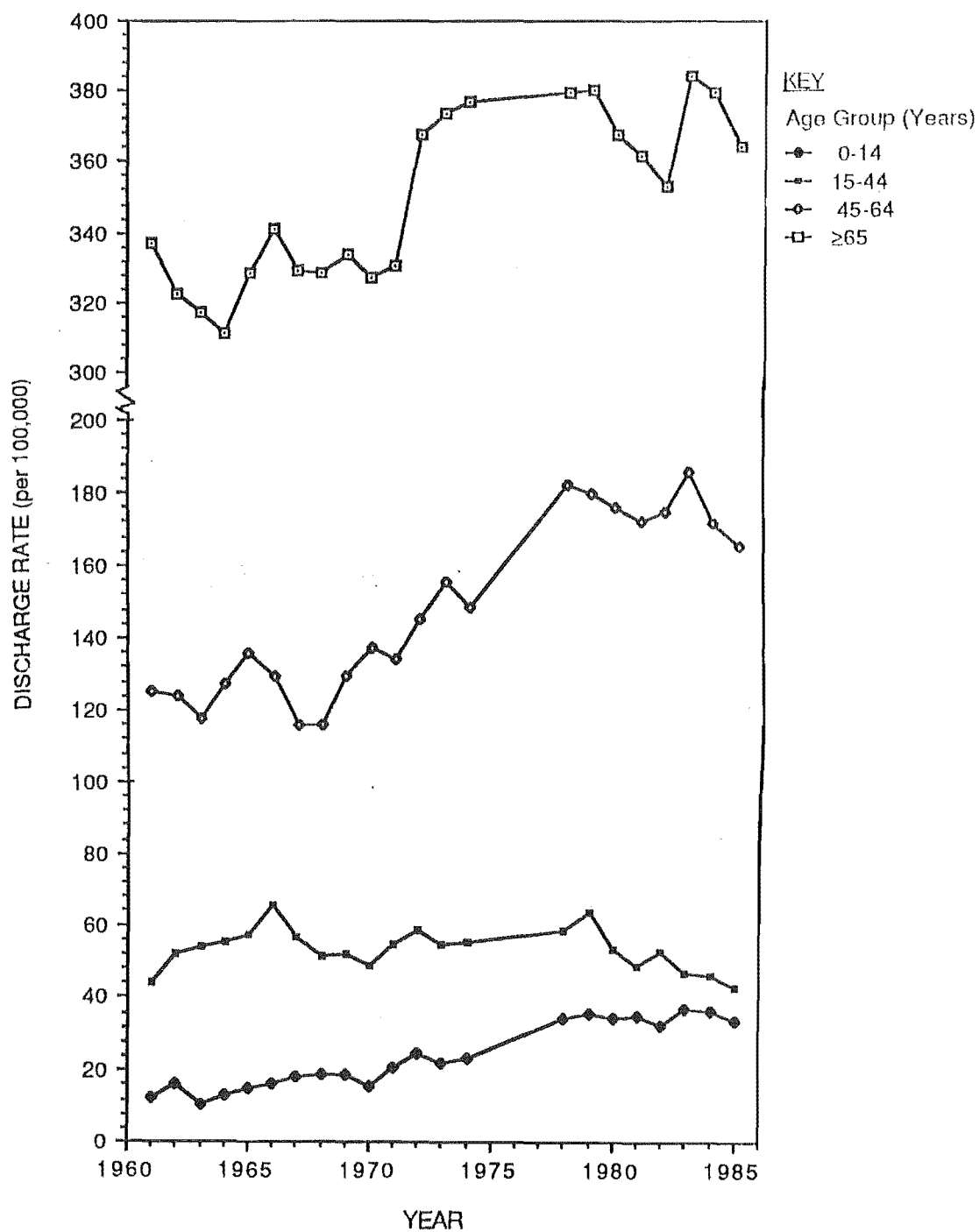


**Figure 7.5:** Rates of Diabetes Hospitalization by Sex.

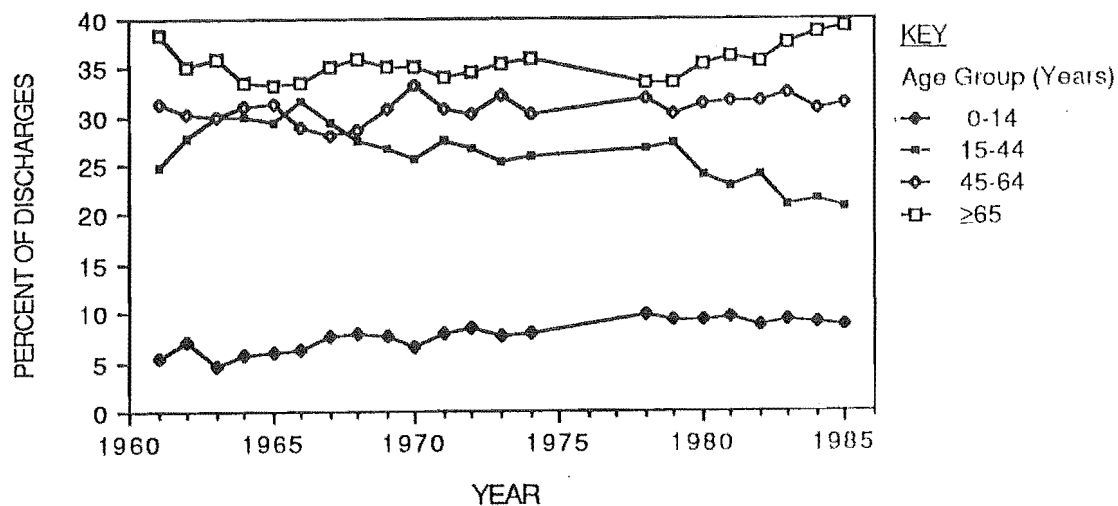
from 59.5 per 100,000 to 102.9 per 100,000. At the start of the study period (1961-1963) admissions to hospital for females outnumbered those for males by a ratio 1.39:1.00. This differential in discharge numbers and rates had been eroded by 1980. The reasons for this convergence are unclear. It is unlikely that sex differences in either diabetes prevalence or morbidity could account for this. Rather, the explanation is more likely to be found in changes in medical practice with less discrimination in the perceived needs and treatment of males and females.

Patterns of hospitalization reflect the age bias of the disorder. Age-specific discharge rates are shown in Figure 7.6. Two main observations can be made. First, the elderly are hospitalized (for diabetes) much more frequently on a per capita basis than younger age-groups. This reflects the increased prevalence of diabetes with age and the greater risk of elderly persons to hospitalization (Harrower, 1980; Beaven and Scott, 1986B; Damsgaard et al, 1987). Secondly, age-specific rates increased significantly over the 25 years for all age-groups except young adults.

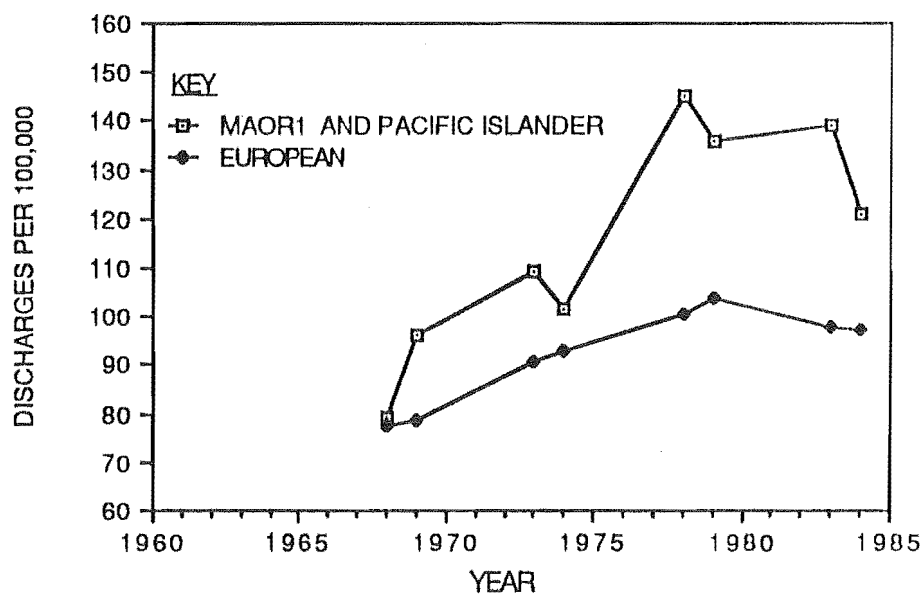
Not unexpectedly, the elderly contribute to the largest proportion of discharges (Figure 7.7) and this proportion has been increasing in recent years. In contrast, the number of discharges attributable to young adults as a proportion of annual totals has dropped noticeably since 1979 (27%) to only 21% of the discharges occurring in 1985. It is in this group of patients, that diabetes education may have its greatest impact. Children comprise the smallest group of diabetic inpatients, but they still contribute to nearly 10% of all discharge events with diabetes as the principal



**Figure 7.6:** Age-Specific Discharge Rates for Diabetes.



**Figure 7.7:** Proportion of Diabetes Discharges by Patient Age.



**Figure 7.8:** Ethnic Differences in Discharge Rates Over Time.

diagnosis. Special consideration may have to be given to better forms of intervention if hospitalization of diabetic children is to be minimized.

Most of the changes in the age-structure of patients has occurred through changes in the age characteristics of the females being admitted rather than males (Table 7.2). Discharge numbers for males have essentially doubled in each age-group. Table 7.2 also shows a marked change occurred in patterns of admission for females aged between 15 and 44 years. This most likely reflects the substantial changes in the care and outcomes of diabetes and pregnancy. This was the only group in whom per capita rates of hospital use did not increase.

Figure 7.8 illustrates the general trends in per capita discharge rates by ethnicity. Increases in hospital use were not dissimilar in the late 1960s - early 1970s. However, there was a substantial rise in hospitalization of Maori and Pacific Islanders for diabetes throughout the 1970s. By 1983-1984, the Polynesian population accounted for around 17-18% of hospital discharges for diabetes, compared to 10% in the late 1960s. The explanation of this is three-fold: hospital use by ethnic minorities has increased as a whole; more importantly there has been a dramatic rise in the prevalence of diabetes in the Polynesian population compared to Caucasians; and increasing numbers of Maoris and Pacific Islanders have developed diabetes complications and, therefore, there is a higher demand for hospital services.

**TABLE 7.2**  
**DISCHARGE FOR DIABETES BY PATIENT AGE-GROUP**  
**AND SEX 1961-1965 AND 1981-1985**

**(a) Female**

	1961-1965		1981-1985		Change in %
	No.	%	No.	%	
0-14	265	4.6	823	10.0	5.4
15-44	1830	31.7	1711	20.8	-10.9
45-64	1615	27.9	2448	29.8	1.9
65+	2071	35.8	3231	39.4	3.6
Total	5781	100.0	8213	100.0	

**(b) Male**

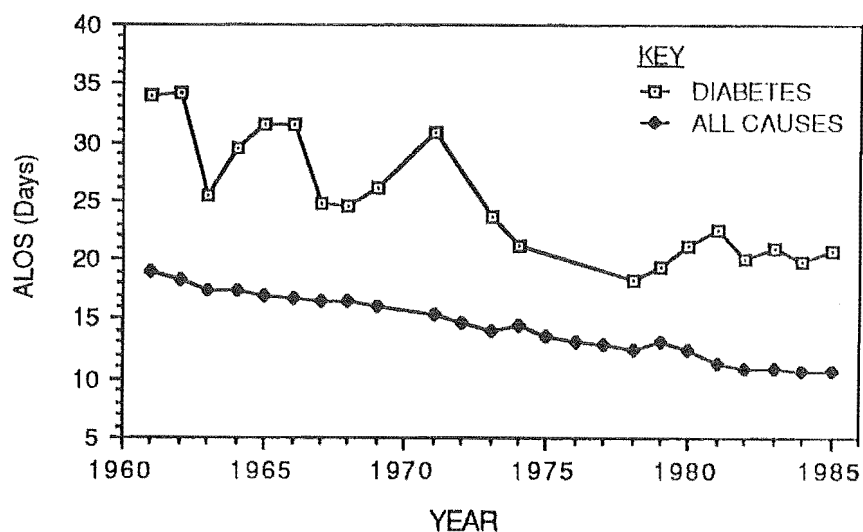
	1961-1965		1981-1985		Change in %
	No.	%	No.	%	
0-14	299	7.4	628	8.0	0.6
15-44	964	23.8	1819	23.2	-0.6
45-64	1404	34.7	2607	33.3	-1.4
65+	1384	34.1	2776	35.5	1.4
Total	4051	100.0	7830	100.0	

**Hospital Stay:** While per capita admissions to hospital have increased, there has been a trend to reduction of average length of hospital stay (ALOS). ALOS has fallen steadily for all causes, and although ALOS is more variable for diabetes, it has also fallen over the twenty-five year period (Figure 7.9). Diminished hospital stay is characteristic of all age-groups, irrespective of cause of admission. This reflects major changes in inpatient management with improved forms of medical treatment and greater support in the community. Hospitals have been able to increase the throughput of patients without sacrificing quality of care.

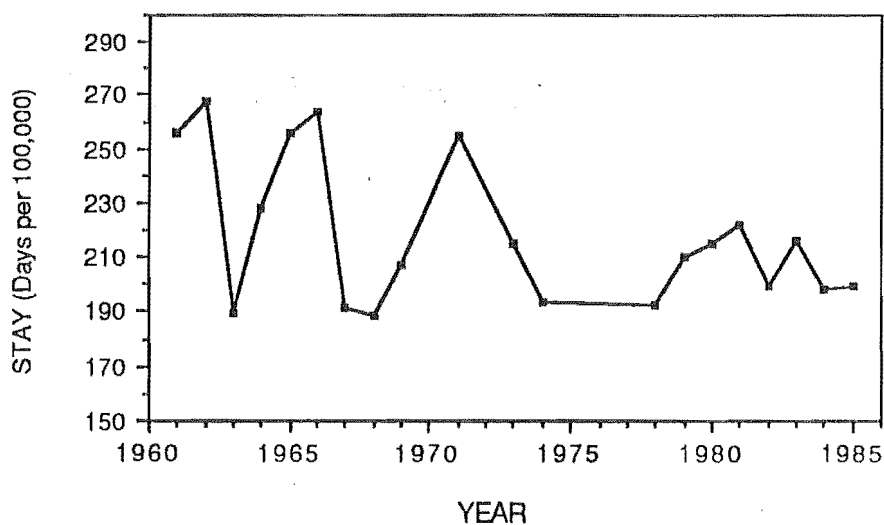
ALOS for diabetes, as the principal cause of admission, is now around 3 weeks, twice the overall ALOS for all causes of hospital admission. This differential in ALOS has been maintained over time, and is typical of all age-groups except the elderly.

Overall, increased admissions with reduced length of stay has meant that hospital bed occupancy for diabetes, as measured by total patient days per 1,000 mean population, has not changed significantly over the twenty-five years (Figure 7.10). While annual variation in the total number of patient days spent in hospital for diabetes has been reduced, rates of patient days has only fallen from 227 days per 1,000 (standard error = 11.3) in the 1960s to 210 (SE = 4.3) in the 1980s. With increased admission and prolonged length of stay, the elderly account for most of this bed occupancy (Figure 7.11). By the 1980s, persons aged 65 or more years contributed to over 65% of patient days. In contrast, children contribute to 5% of patient days.

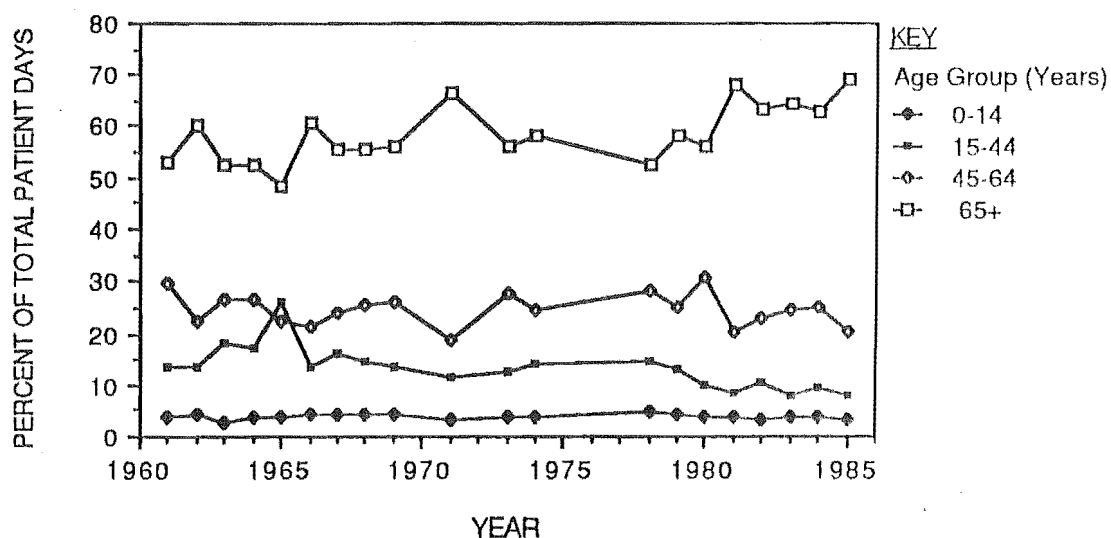




**Figure 7.9:** Average Length of Hospital Stay.



**Figure 7.10:** Trends in Patient Days Stay.



**Figure 7.11:** Proportion of Days Stay by Patient Age.

### **7.3.3 Commentary**

Hospitalization for diabetes, in terms of discharges, has increased above that expected from growth in New Zealand's population and may reflect, in part, increased prevalence of the disorder in the community. The discussion shows that the 1980s have been a relatively stable period in hospital use with both per capita discharge rates and ALOS reaching plateaus. During the last decade, there has been substantial change in the philosophy of diabetes care, and a period of service re-organization.

Although some of the changes evident in the national trends no doubt reflect changes in diabetes morbidity, in the Polynesian population for example, it would also seem that overall changes in hospitalization practices in New Zealand and changes in diabetes care have contributed to these patterns. Diabetes trends often parallel patterns in hospitalization for all causes. It is also difficult to explain the dramatic rise in hospitalization of males in terms of diabetes prevalence, and the trends observed for patients aged 15-44 years suggest an impact of changing admission practices. The introduction of new treatment methods and community and patient education initiatives for this group may be a key factor in these changes.

## **7.4 REGIONAL VARIATIONS IN DIABETES**

### **HOSPITALIZATION: METHODS**

Within this context, the remainder of the Chapter focuses on area variations in diabetes hospitalization. The time frame is the eight years 1979 to 1986 inclusive.

#### **7.4.1 Data and Methods**

All data on hospital use were obtained from NHSC and are in keeping with and subject to their practices and regulations. The database for this regional study comprises all discharges from New Zealand public hospitals identified in the national A & D system as having a primary diagnosis of ICD Code 250, Diabetes Mellitus, irrespective of hospital bed type used or locality of admission. The data includes deaths in hospital and count re-admissions as separate hospital episodes.

Data was sought on standard measures of hospital use, namely number of discharges, patient days (total days stay) and ALOS for the period 1978-1986 inclusive. Gender, age (5 year age-groups), race (European and other, Maori and Pacific Islander) and geographic (county and main urban areas) break-downs of the data were obtained. Output received from NHSC took the form of cross-tabular computer printouts of both the number of discharges and days stay accredited to each age-group in each area. Tables were produced for males and females, and for both the European and Polynesian populations. Separate data runs were generated for each individual year in the study period.

The discharge and total days stay data were then converted to population-based measures of hospital utilization. The outcome, or dependent, variables used in measuring hospital use are:

- (1) Discharge rate: measured as the annual number of discharges from all hospitals for diabetes attributed to residents of a specified area per 10,000 head of population of that area,
- (2) Patient days per 10,000 population: measured as the total number of days spent in hospital by an area's population for diabetes per 10,000 population per year, and
- (3) ALOS: measured as patient days spent in hospital by an area's population per year divided by the number of discharges attributed to that area's population.

Measuring rates of hospital use is not straight-forward since people living in separate residential areas may obtain care from several hospitals serving their areas from locations within or outside the area boundaries. The nature of the research tasks determines in the most part, whether the investigator adopts a population or service based approach to calculating hospital use rates. In this case, the main concern is with regional disparities and inequities in people's use of hospital services for diabetes. The prime objective of the macro-analysis is to examine the relationship between the level of resources available to area populations and their rates of hospital use for diabetes. As Barnes (1982) states if one is considering the interests of individuals in a community that have been, or may be hospitalized, then per capita rates based on census populations are pertinent since people are concerned with the adequacy of the aggregated services from all hospitals available to serve their community. A census-based population approach was therefore

adopted in favour of the hospital-service catchment population. A good discussion on population based approaches used in small area analysis of health care is provided by Barnes (1982). Hospital discharge data was thus, broken down by areas in which patients lived rather than the areas in which they were hospitalized.

The population denominator used to calculate the discharge and day stay rates was the usually resident New Zealand population. The definition of this population is given in Appendix C.2, "Technical Notes to Chapter Seven". Some population data were obtained directly from the New Zealand Department of Statistics, but most were extracted from three data sources published by the Statistics Department for New Zealand's Census of Population and Dwellings. These were:

- (1) the volumes on ages and marital status for the 1976, 1981 and 1986 census;
- (2) the regional statistics series of bulletins again for 1976, 1981 and 1986; and
- (3) the one-off publication for hospital board districts and health districts (Series B, Report 26) produced recently by the Department using 1986 census data.

Annual area populations were interpolated for non-census years. The method used in calculating these is given in the technical notes (Appendix C.2).

The request of data from NHSC was on the assumption that any admission coded with an "A Listing" ICD Code 250 was a valid inclusion in the database. Given that diabetes morbidity is associated with a variety of complications with varying and often "long" lengths of stay (Brown et al, 1985), it was considered inappropriate to select or exclude admissions on the basis of duration of hospital stay. No allowance was therefore made for length of hospital stay.

However, the data revealed that a small number of discharges, although classified as being caused by diabetes, involved exceptionally long lengths of stay. The maximum stay that could be identified for an individual case was 3255 days attributable to an 85 year old lady discharged (presumably dead) from hospital in 1984. Although few admissions approached such a duration of stay, long stay episodes pose problems because, whilst they are valid inclusions in the database (inclusion criteria pre-determined by the ICD method), they introduce considerable variability into the patient days and ALOS data at a disaggregated level.

In an attempt to overcome this problem, a second data set was established to be used in examining hospital stay. The adjusted data were derived by removing any cell in the original data set that had an ALOS in excess of three months. Since the NHSC data was in an aggregate form, it was only possible to identify long stay admissions with respect to the ALOS of age-group area cells. Only when one observation fell into a particular cell was it possible to identify individual cases. Although this method is not optimal, it is pragmatic given the nature of the data. Error in removing valid cases is partly counter-balanced by inclusion of long stay admissions that are

masked by the averaging of data for similarly aged and domiciled individuals.

Details of the discharges pertaining to the "outlying" cells are provided in Appendix C.3. Overall, less than 3.5% of discharges were removed in any one year, and slightly higher percentages were removed for males than females. These discharges are clearly associated with nursing care of the elderly. Only 11.2% of the "long stay" events were attributed to people under 60 years of age and all involved persons over 40 years of age. The majority of the male admissions (42.3%) involved men aged 70-79 years, and the female admissions (48.9%), women aged 80 or more years. Although comprising relatively few discharges, these hospital episodes contributed up to 37.5% of total patient days per annum. The proportion of days removed from the analysis varied between males and females and between years. Geriatric patients (70 years and over) contributed to 77.8% of all the patient days removed.

#### **7.4.2 Area Unit of Analysis**

The hospital board district was chosen as the geographic unit of analysis for three reasons. First, the aim of small area analysis is to uncover the relationship between resource availability and use, and to capture the nuances embedded in local health practices. Hospital (area health) Board districts are well defined geographic and health administrative regions. They are meaningful in terms of their community/regional identity both with respect to people's sense of belonging and the organization and use of health care.

Second, patient domicile at time of admission is coded routinely on hospital discharge sheets by urban subdivision (suburb) or small county unit. Each discharge can therefore be classified according to the patient's place of residence into a hierarchy of spatial units. Consideration must, however, be given to the internal stability of data associated with different levels of spatial aggregation. Small areas often have exceptionally high (or low) rates of hospitalization, because of a few admission episodes. Larger units are more reliable because they are not so susceptible to random fluctuations. Disaggregation of data may have little operational significance, the additional information is often irrelevant and unhelpful, and the increased statistical noise associated with the smaller unit becomes limiting (Barnes, 1982). Diabetes discharges total approximately 3,200 per annum, and thus division into small county units, would mean many areas would record few or no hospital events.

Geographic units need to be sufficiently large so as to obtain meaningful and statistically "stable" hospitalization rates. Aggregate data may however obscure important variations, and thus, limit the confidence of the researcher in making inferences and/or conclusions about the importance of regional doctor-hospital practices. Wennberg and colleagues (1982) report that researchers investigating small area variations in health care in the U.S. usually amalgamate small demographic units to form areas with population sizes typically in the range of 10,000 - 100,000 persons. While, in the American context, such area units comprise small areas, this is the size range of most New Zealand Hospital Boards.



Third, the choice of area units influences the choice of predictor variables and measures of hospital use, and the relationship expected to occur between factors of need and resource supply. Furthermore, the area unit analysis on a more practical level affects the availability of and the researcher's ability to secure pertinent and reliable data. Quinquennial censuses provide suitable social and demographic data at a disaggregate level, but geographic information systems for detailing morbidity/mortality, and especially medical work force and health services data, are lacking. When information is available, it is typically generated only at the level of the hospital board.

New Zealand's hospital service is spatially and organizationally concentrated. Hospitals are primarily located in the main or secondary urban centres. They have regional functions serving their board area, rather than having set local affiliations. Defining such variables as bed supply or availability of specialist medical practitioners is problematic at lower levels of analysis because many areas do not have hospital services within their community boundaries. Provision of hospital services in New Zealand is a regional rather than local phenomenon.

For these reasons, the hospital board district is the only viable area unit to work with in empirically modelling diabetes hospitalization. However, acquisition of the NHSC data at the county and urban level allowed freedom in choosing the degree of spatial aggregation.

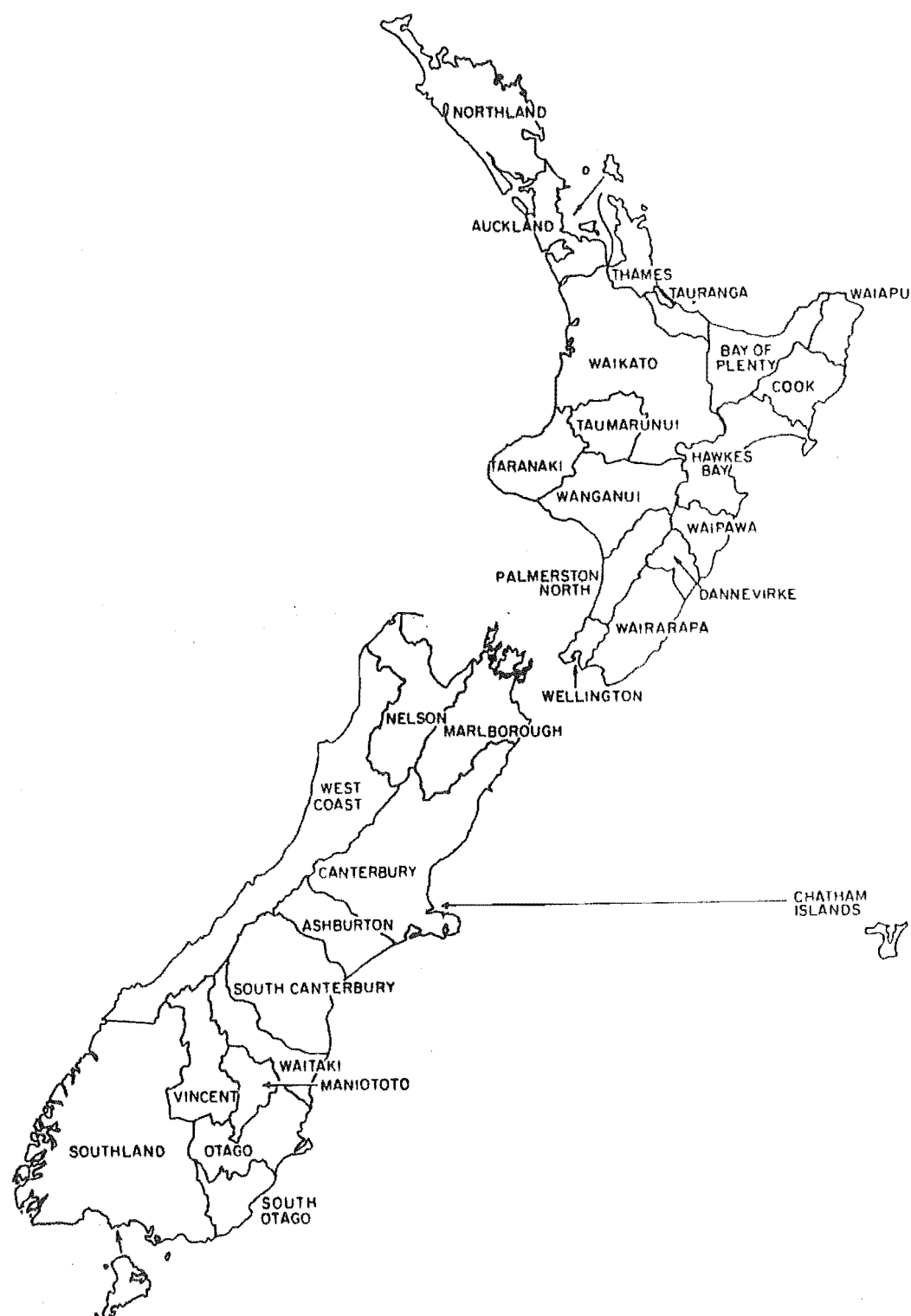
All the county data was aggregated into the 29 hospital board regions (Figure 7.12). These areas ranged in population size in 1986 from just under 2,500 persons in Maniototo to over 875,000 in Auckland (see Appendix C.2 for board populations). Two boards, Maniototo and Waipatu were excluded from the analysis because of their very small usually resident populations (2370 and 4572 respectively) and the large fluctuations and instability in their hospitalization rates. The remaining boards all had population in excess of 10,000 persons.

One further alteration was made to the database. Although 1978 was chosen as the starting point because community initiatives in diabetes care were not established in New Zealand, it had to be dropped from the analysis. A significant proportion (6.5%) of total discharges enumerated by NHSC in its annual hospital and selected morbidity data series had not been geo-coded. This was an unacceptable level of omission given the size of some of the board districts. In contrast, ascertainment exceeded 99.5% in most other years, the differences being attributable to admissions by overseas visitors or the shipboard population or to missing coding variables.

## **7.5 REGIONAL VARIATIONS IN DIABETES**

### **HOSPITALIZATION: DESCRIPTIVE RESULTS**

This section presents descriptive results of variations in hospital discharge and length of stay for diabetes between hospital board populations during the 8 year study period 1979 to 1986. Chapter Eight, then examines the relationship of these patterns to



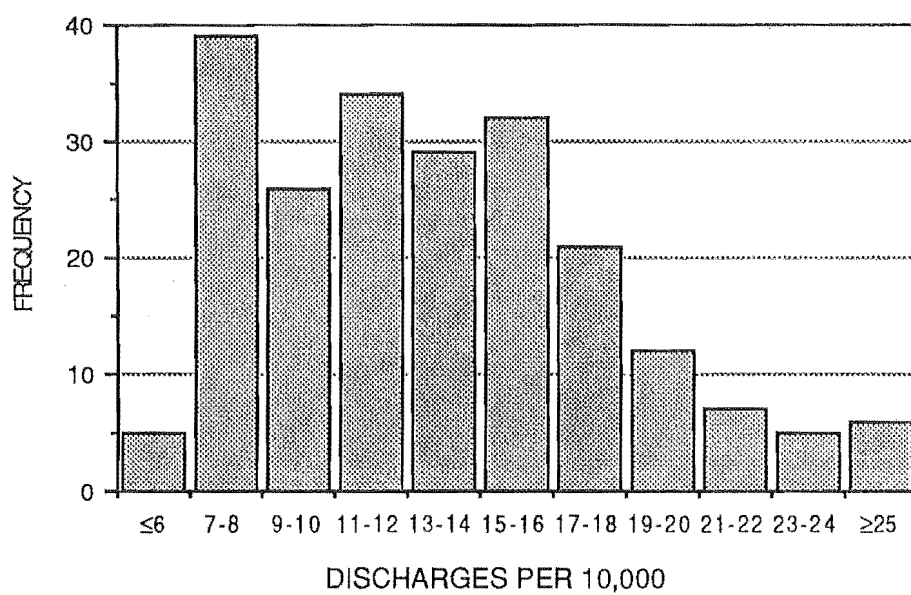
**Figure 7.12:** Regional Health Authorities in New Zealand.

the supply of health care resources that are available to each regional population.

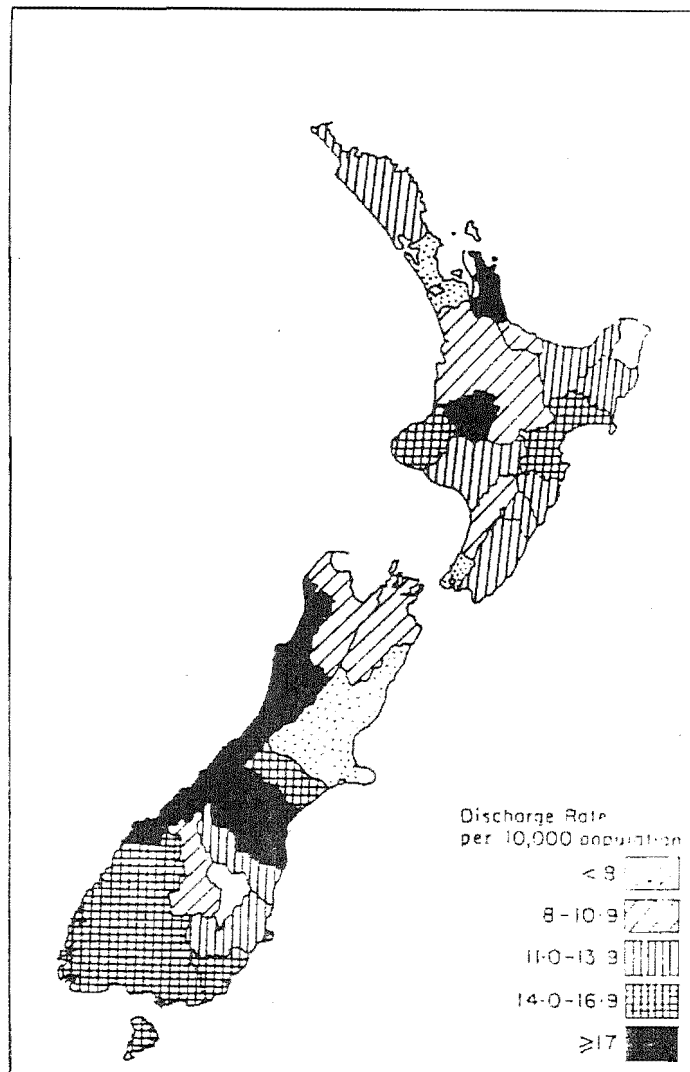
### **7.5.1 Discharges from Hospital**

During the study period, per capita discharge rates for the 27 board areas ranged from a low of 3 per 10,000 observed in 1986 for residents of the small rural Central Otago Hospital Board of Vincent, to a high of 20 per 10,000 in 1985 for the equally small rural North Island community of Taumaranui. Of the total 216 annual area discharge rates enumerated (27 areas x 8 years), 75% fell between 8 and 16 per 10,000 and the overall annual area mean was 13 per 10,000 (Figure 7.13) (these rates represent all hospital admissions irrespective of length of hospital stay).

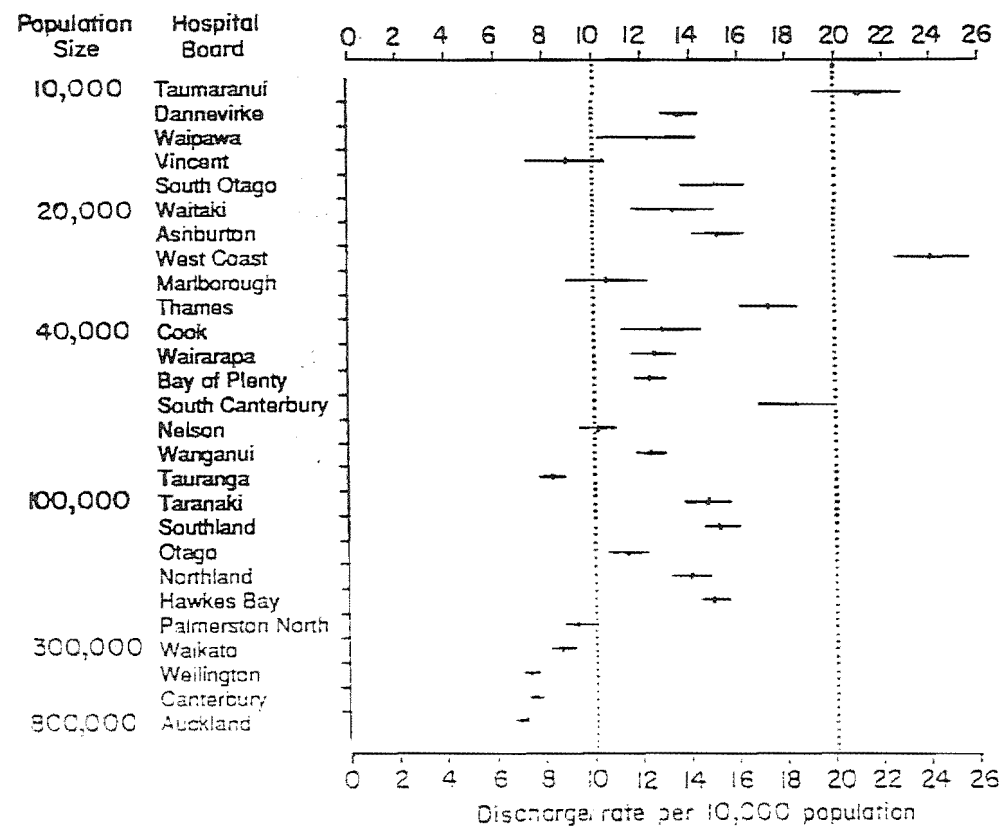
Discharge rates did vary significantly between the 27 board areas (ANOVA,  $p < 0.001$ ). The variability in area discharge rates, averaged over the 8 years for each region, is shown in Figure 7.14, and accompanying summary statistics provided in Figure 7.15. This pattern of hospitalization is in keeping with general patterns of morbidity and hospital use in New Zealand. Four areas have noticeably high rates of hospitalization for diabetes - the West Coast, South Canterbury, Taumaranui, and Thames. The areas tend to rank low on most available social and economic indicators. Annual discharge rates also fluctuate quite markedly in these regions. In addition, the southern half of the South Island (with Vincent as an enclave), provides a contiguous zone of relatively high rates of hospital admission for diabetes, the explanation being found jointly in diabetes epidemiology and health care practices.



**Figure 7.13:** Annual Area Discharge Rates (Per 10,000 Population) for Diabetes 1979-1986.



**Figure 7.14:** Spatial Variations in Diabetes Discharge (Area Annual Means 1979-1986).



**Figure 7.15:** Variations in Discharge Rates by Hospital Boards (Mean  $\pm$  SEM, Standard Error of the Mean).

In contrast to these high areas, are the large urban based hospital boards which consistently rank as low hospital use areas. Rates in Auckland, Canterbury, Wellington, Waikato and Palmerston North are typically 2-3 fold lower than the rates observed for board areas at the opposite end of the hospital service and population hierarchies. This finding is similar to that found by Barnett et al (1980) for all non-psychiatric admission to hospital. Otago, with its strong tradition in medical care (through the Otago Medical School), has higher discharge rates.

An ANOVA of discharge rates by sex and area showed that significant, and consistent, differences did occur in some areas between male and female rates of hospital use (Table 7.3). Females were hospitalized more frequently than males in each of the 8 years in Wairarapa, West Coast and Dannevirke, and 6 out of 8 in both Hawkes Bay and South Otago. Similarly, in both Ashburton and Taumaranui, discharges rates were higher for males in 7 of the years and for 5 in South Canterbury. Least difference in per capita hospitalization rate between the sexes, occurs in the more populous boards.

The proportion of discharges attributable to the Polynesian population varies considerably across hospital board area (Figure 7.16). This pattern reflects the overall residential bias of this population. In 1986, the year on which this map is based, Maori and Pacific Islanders accounted for over half of all the diabetes discharges being attributed to residents of Northland, Bay of Islands and Taumaranui and over thirty percent in Auckland and Hawkes Bay.

TABLE 7.3

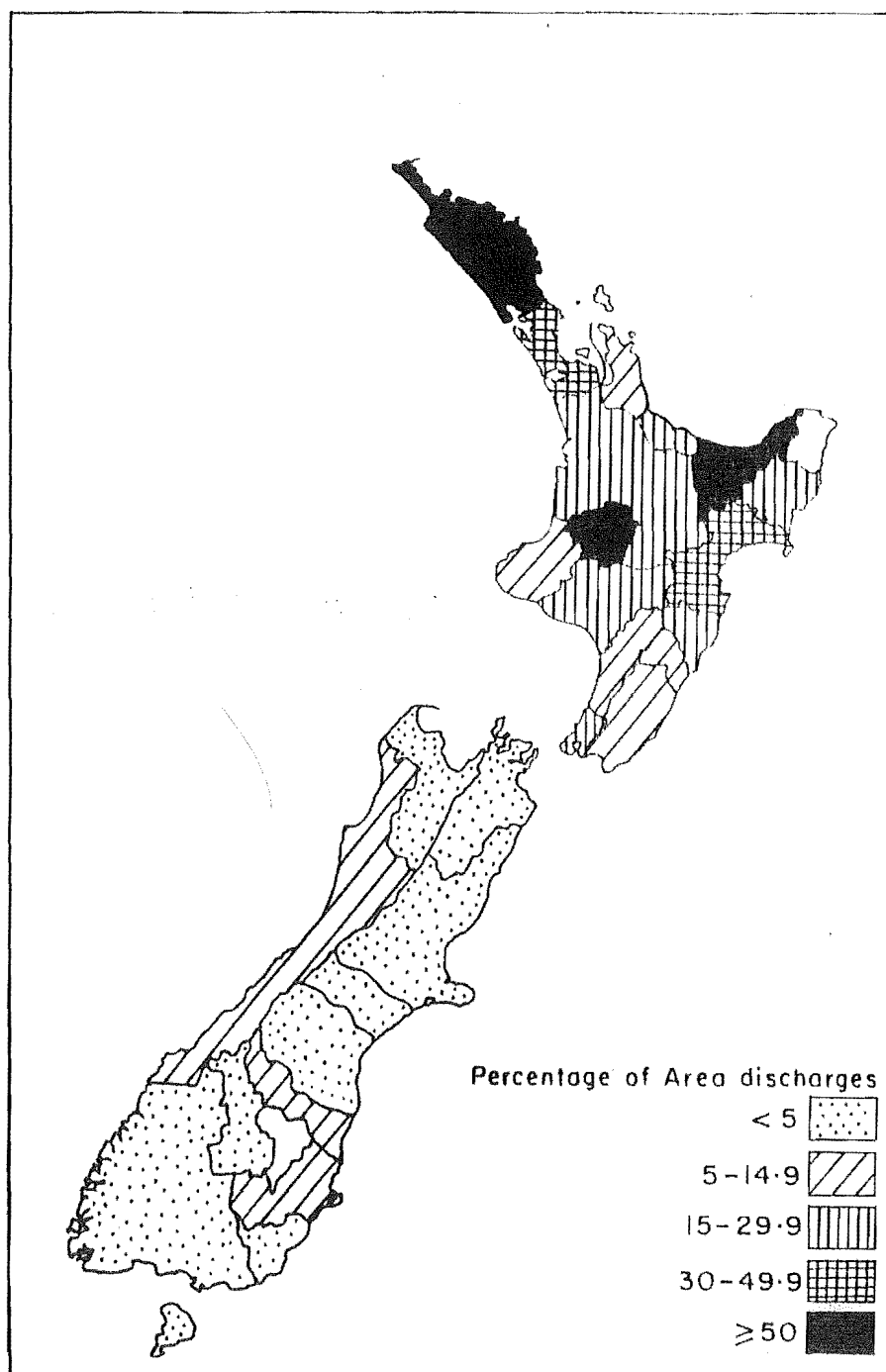
## AREA VARIATIONS IN DISCHARGE RATES BY SEX 1979-1986

Hospital Board Area	Females Mean $\pm$ SE	Males Mean $\pm$ SE
Auckland	7.0 $\pm$ 0.4	7.1 $\pm$ 0.3
Canterbury	7.7 $\pm$ 0.5	7.4 $\pm$ 0.3
Wellington	7.8 $\pm$ 0.3	7.0 $\pm$ 0.2
Waikato	9.3 $\pm$ 0.4	8.2 $\pm$ 0.6
Palmerston North	10.2 $\pm$ 0.7	8.7 $\pm$ 0.6
Hawkes Bay	16.3 $\pm$ 0.8	13.9 $\pm$ 0.8*
Northland	14.0 $\pm$ 1.2	13.9 $\pm$ 0.6
Otago	12.1 $\pm$ 0.9	10.9 $\pm$ 0.7
Southland	15.5 $\pm$ 1.0	15.1 $\pm$ 0.5
Taranaki	14.5 $\pm$ 1.0	15.2 $\pm$ 1.2
Tauranga	8.9 $\pm$ 0.7	7.6 $\pm$ 0.5
Wanganui	13.1 $\pm$ 0.7	12.0 $\pm$ 0.5
Nelson	9.7 $\pm$ 0.5	11.1 $\pm$ 0.8
South Canterbury	16.8 $\pm$ 1.5	20.1 $\pm$ 1.8**
Bay of Plenty	13.6 $\pm$ 1.0	11.3 $\pm$ 0.8
Wairarapa	14.5 $\pm$ 1.1	10.5 $\pm$ 1.0**
Cook	13.5 $\pm$ 1.7	11.8 $\pm$ 2.0
Thames	16.8 $\pm$ 0.9	17.7 $\pm$ 2.2
Marlborough	12.7 $\pm$ 1.7	8.6 $\pm$ 1.7
West Coast	27.0 $\pm$ 1.0	21.3 $\pm$ 2.2*
Ashburton	12.0 $\pm$ 1.4	18.4 $\pm$ 1.8**
Waitaki	12.6 $\pm$ 1.2	14.6 $\pm$ 1.8
South Otago	17.8 $\pm$ 1.9	12.5 $\pm$ 1.5*
Vincent	8.8 $\pm$ 2.6	9.3 $\pm$ 1.7
Waipawa	13.5 $\pm$ 3.2	10.7 $\pm$ 1.9
Dannevirke	17.3 $\pm$ 1.4	9.9 $\pm$ 1.0**
Taumaranui	15.9 $\pm$ 2.2	25.6 $\pm$ 2.1**
Total	13.3	12.6

\* p &lt; 0.05

\*\* p &lt; 0.01





**Figure 7.16:** Spatial Variation in the Proportion of Diabetes Discharges Attributed to the Polynesian Population (1986).

This illustrates the numerical seriousness of hospitalization of this ethnic group in these parts of the North Island. It does not, however, indicate whether or not there is a discrepancy in hospitalization on a per capita basis between the Polynesian and European populations.

The stability of per capita discharge rates for Maoris and Pacific Islanders is questionable in many parts of the country because there are so few admissions per annum. One or two additional episodes severely compromise an area's rate. Fewer than 10 discharges were recorded for Maori and Pacific Island people in 17 of the 27 board areas in 1979 and 16 in 1986. A comparison between race-specific discharge rates is, however, presented in Table 7.4 which presents data for 7 select areas. Each of these regions had 20 or more discharge events enumerated for the Polynesian population each year.

This suggests considerable variation occurs in race specific rates between areas and between years. For example, Northland had extremely high rates of hospitalization of Maori and Pacific Island people in 1979, but admission levels have halved in the eight years. This situation also occurred for European admissions, and presumably reflects changes in the provision of health care and admission practices. Large discrepancies remain between these two ethnic groups. Overall, Maori and Pacific Islanders have substantially higher per capita discharge rates through increased prevalence of the disorder and demand for hospital care.

**TABLE 7.4**  
**VARIATIONS IN DISCHARGE RATE**  
**(DISCHARGES PER 10,000 PERSONS) BY ETHNICITY**  
**FOR SELECTED AREAS**

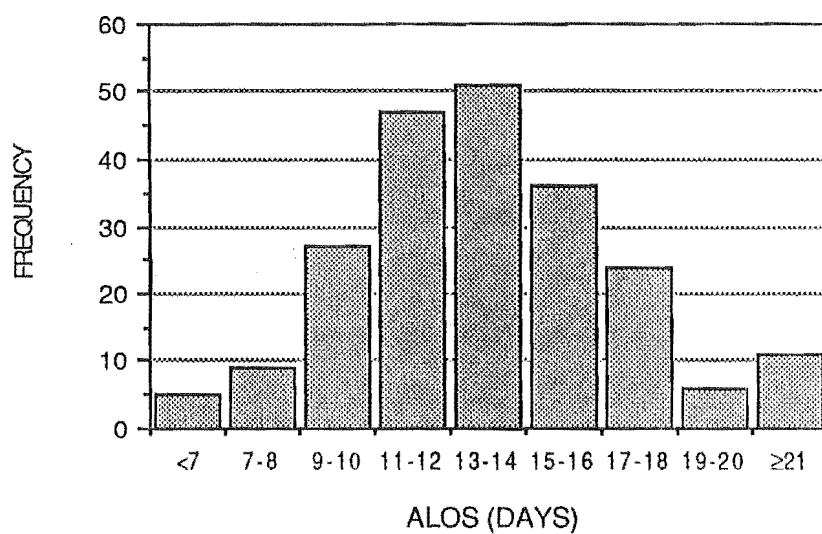
<b>Area</b>	<b>Polynesian</b>		<b>European (and Other)</b>	
	<b>1979</b>	<b>1986</b>	<b>1979</b>	<b>1986</b>
Auckland	9.8	12.4	6.7	7.1
Northland	40.1	20.2	13.1	5.7
Waikato	9.7	7.7	7.0	7.7
Bay of Plenty	11.4	16.2	11.1	8.5
Hawkes Bay	23.5	21.5	14.9	11.8
Wanganui	26.0	15.7	13.4	10.7
Wellington	5.5	9.6	8.0	7.2

### 7.5.2 Hospital Stay

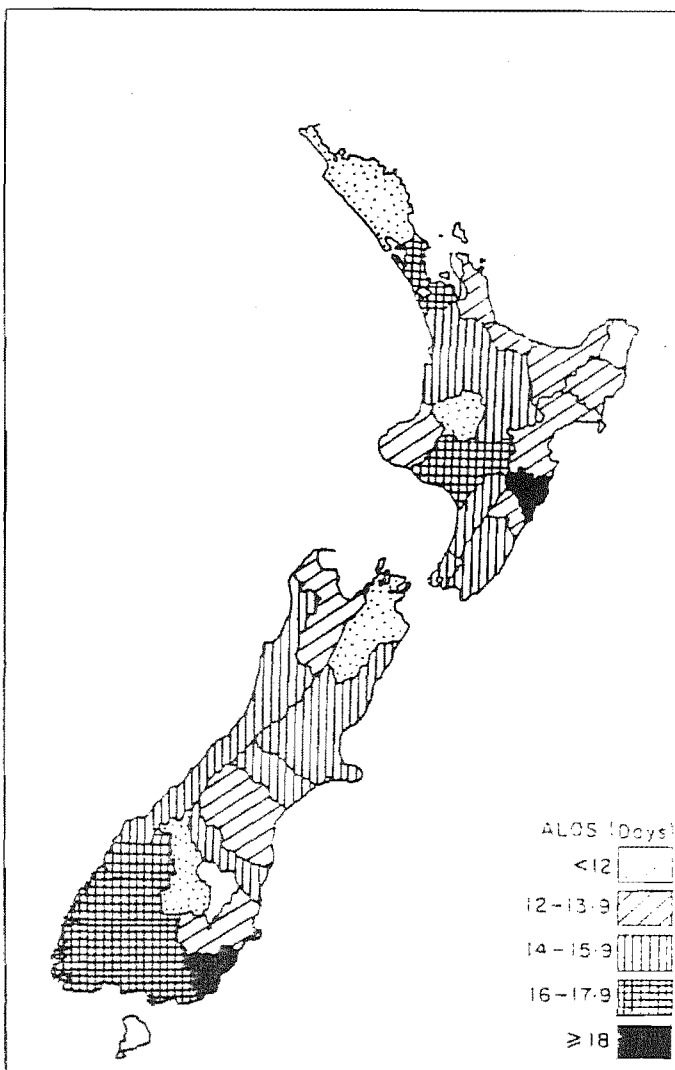
This section examines patterns of hospital stay using the adjusted dataset which had removed the effects of the very long stay events (refer to Section 7.4). Details for each board area of the discharges in the outlier cells and their contribution to total discharge numbers and patient days over the total 8 years are given in Appendix C.3.

Considerable variation remains in hospital stay between board populations. ALOS varied over the study period from an annual area low of 3.3 days in Vincent in 1985 to a maximum of 37 days recorded by residents of Waipawa in 1982. The histogram of ALOS (Figure 7.17) is normally distributed with the annual area mean at 14.1 days (note: the national data in Section 7.3 includes all discharges and is weighted by board size).

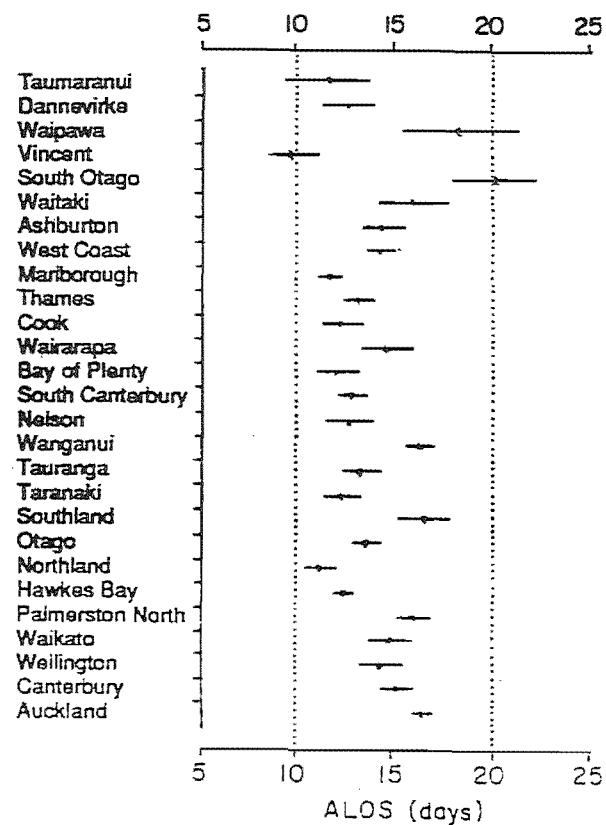
The spatial variation in ALOS for residents of the different board areas is reflected by Figures 7.18 and 7.19. Board populations do differ in their mean duration of hospital stay for diabetes care (ANOVA,  $p < 0.001$ ). South Otago, Southland, Wanganui and Waipawa tend to have prolonged hospital stay. The largely urban-based populations were not noted for having shortened ALOS, but rather maintained average durations of stay slightly over a fortnight. This finding is in contrast to that expected from general trends in hospitalization (Barnett et al, 1980) and suggests ALOS for diabetes may be independent of hospital bed supply. Areas with high per capita discharge rates did not necessarily have prolonged stays in hospital.



**Figure 7.17:** Distribution of ALOS Observations.



**Figure 7.18:** Spatial Variation in Mean Annual ALOS by Hospital Board.

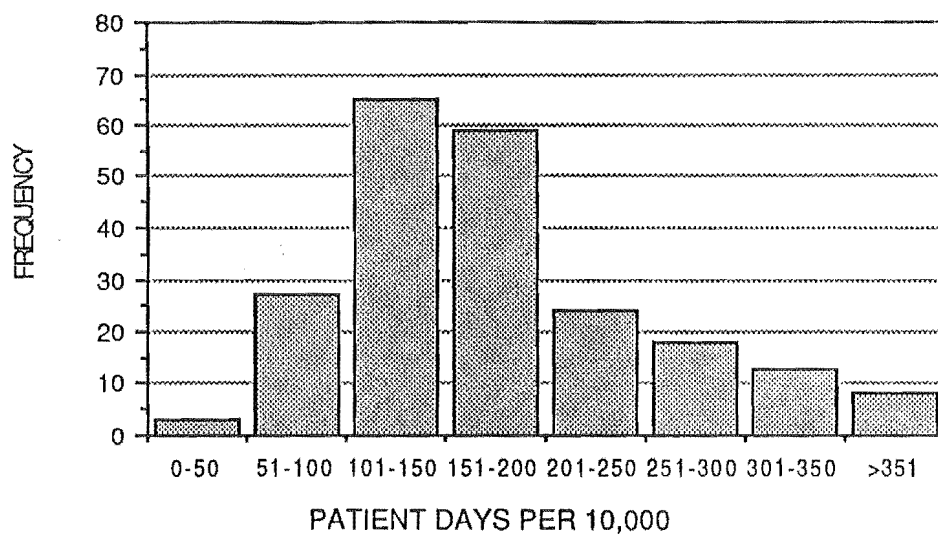


**Figure 7.19:** Variation in ALOS for Each Hospital Board Area 1979-1986 (Mean  $\pm$  SEM).

Males stayed on average the same length of time as females, and no significant interaction was observed between sex and board of domicile.

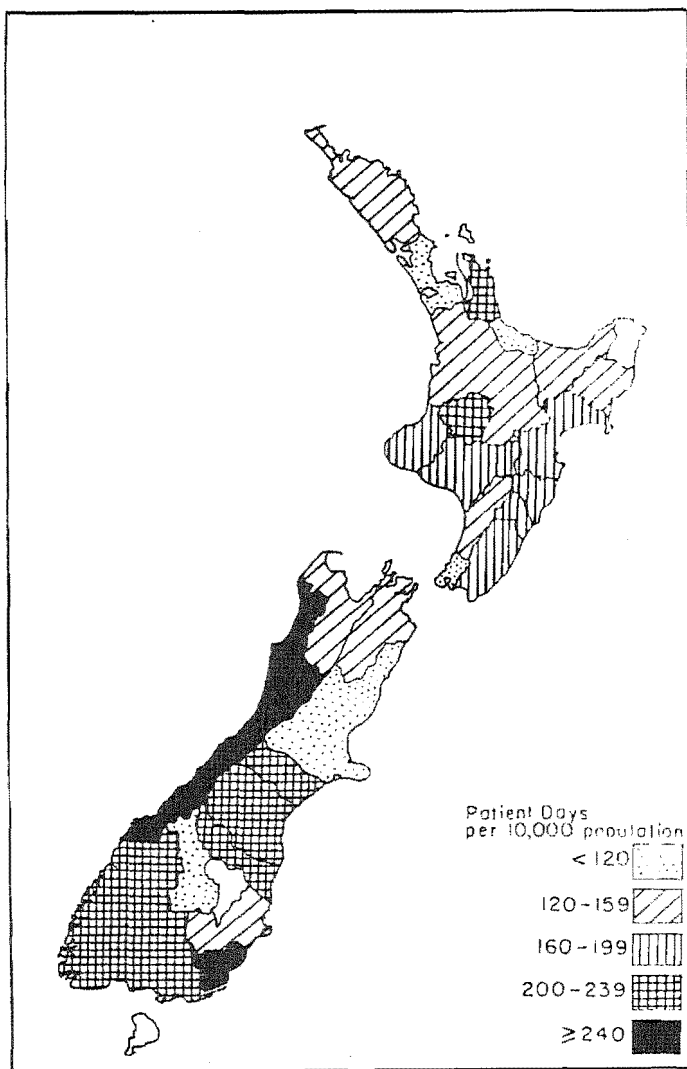
The combined effects of varying discharge rates and mean durations of hospital stay give rise to significant spatial differences in per capita rates of total days stay spent in hospital by the 27 board populations. Area variation in patient days is shown in Figure 7.20-7.22. Rates of total days stay per capita are positively skewed (moment coefficient of skewness for all annual-area observations = 1.19) with values ranging from 11 days per 10,000 (Vincent) to the maximum outlier of 544 recorded in Taumaranui. In total, 19% of annual area rates exceeded 250 days per 10,000 population and 7 values exceeded 350 days. As Figures 7.21 and 7.22 show, West Coast and South Otago stand out as areas of high hospital use for diabetes. The means of the annual rates for these two areas over the 8 years were 330 and 279 per 10,000 respectively. West Coast residents contributed to over 250 days of hospitalization per 10,000 population in each of the 8 years, and in excess of 350 days annually from 1979 to 1982. People living in South Otago were attributed with total patient days in excess of 250 days per 10,000 residents in 5 of the 8 years.

As expected from the previous discussion, areas with smaller population sizes show greatest annual variation in days stay. Auckland, Canterbury and Wellington, along with Vincent, exhibit overall low rates of hospital use on a per capita basis. Three other areas also have noticeably below average bed occupancy rates. These

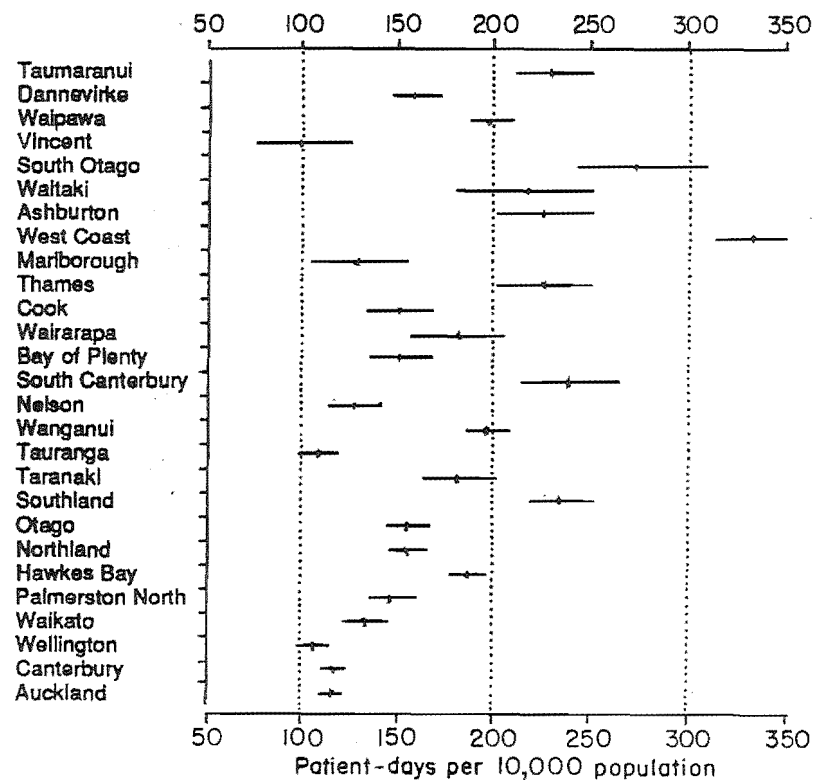


**Figure 7.20:** Distribution of Annual Area Rates of Patient Days.





**Figure 7.21:** Spatial Variation in Mean Annual Area Rates of Hospital Stay (Patient Days Per 10,000 Population).



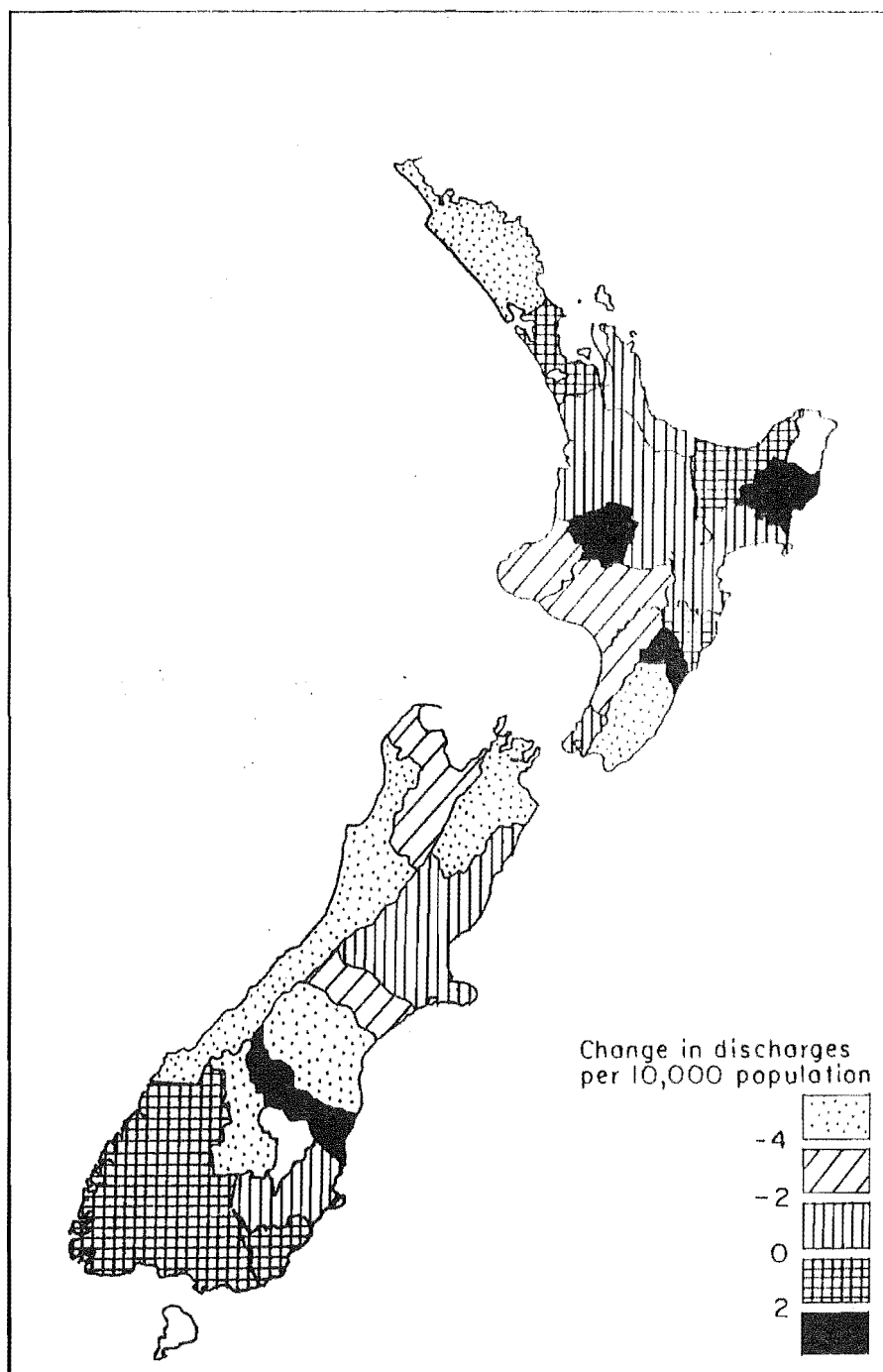
**Figure 7.22:** Variation in Hospital Stay by Hospital Board Area 1979-1986 (Mean  $\pm$  SEM).

are Tauranga, Nelson and Marlborough. Each of these areas is known for its "sun 'n sea" attributes, and even though they have relatively high proportions of elderly residents, the populations tend to be "healthy" (these areas have low standard mortality ratios).

### **7.5.3 Change Over the Eight Years**

Results presented to date illustrate the variation that occurs between hospital board populations in their rates of hospital use for diabetes. The data reveal considerable spatial and temporal fluctuations in regional patterns of hospital utilization. This section examines patterns of change over the study period. At the national level, rates of diabetes hospitalization had stabilized following abrupt rises in admissions during the 1960s and 1970s. Considerable interest in diabetes care has been devoted to the potential benefits of diabetes patient education. The concept of ambulatory diabetes care with reduced requirements for hospitalization is well accepted. This section addresses two questions: what change is evident at the regional level, and have different board populations experienced different levels of change in hospital use? Data was averaged for 1979 and 1980 to represent patterns at the beginning of the study period and 1985 and 1986 for the end of the period.

Overall, annual area discharge rates fell on average by 1.5 discharges per 10,000 from a mean of 13.5 in 1979/80 to 12.0 in 1985/86 ( $p = 0.06$ ). Areas experienced marked differences in changes in hospital use over this time, (Figure 7.23 and Table 7.5). Discharges per capita increased in 10 of the 27 boards, although this change was relatively insignificant for Wellington, Waipawa and South



**Figure 7.23:** Changes in Hospital Discharge Rates by Hospital Board Area (1979/1980 - 1985/1986).

TABLE 7.5

## CHANGES IN HOSPITAL USE BY BOARD AREA 1979/80 - 1985/86

Board	Discharges Per 10,000		ALOS		Patient Days Per 10,000	
	1979/80	1985/86	1979/80	1985/86	1979/80	1985/86
Marlborough	17.2	7.2	14.0	11.1	239.3	80.0
West Coast	27.8	19.7	13.0	14.9	359.0	287.4
Vincent	11.5	4.3	12.3	3.4	143.3	14.3
South Canterbury	22.3	15.7	12.5	12.8	277.1	198.4
Wairarapa	15.4	9.4	18.2	16.0	269.9	144.4
Northland	16.5	11.3	11.3	12.4	184.1	132.0
Ashburton	16.3	12.9	14.3	12.1	220.6	159.5
Palmerston North	11.2	8.2	17.3	16.3	188.1	131.1
Nelson	11.5	8.8	13.9	12.5	161.3	107.9
Taranaki	14.5	12.2	13.4	10.2	189.2	127.0
Wanganui	13.6	11.5	16.7	17.3	221.5	179.3
Waikato	9.0	7.6	16.2	13.6	146.3	101.8
Canterbury	8.6	7.3	13.8	16.0	118.1	117.2
Thames	17.0	15.7	14.3	12.3	236.3	197.5
Otago	13.3	12.3	12.1	14.2	164.9	170.7
Hawkes Bay	15.2	14.3	13.8	12.8	206.1	179.4
Tauranga	8.4	7.9	15.4	15.1	125.9	118.5
South Otago	14.0	14.4	16.9	27.6	229.0	372.3
Waipawa	14.1	14.5	18.5	6.8	233.4	85.3
Wellington	7.2	7.7	18.5	14.1	126.9	105.8
Bay of Plenty	11.4	12.4	16.9	10.3	192.0	124.1
Auckland	6.5	7.8	15.7	14.8	102.6	112.8
Southland	13.2	14.9	20.2	15.3	247.5	210.1
Cook	8.3	10.8	16.3	11.1	136.1	118.0
Dannevirke	11.3	16.2	12.7	9.7	140.5	156.2
Waitaki	9.9	15.0	13.8	13.8	139.3	203.0
Taumaranui	19.4	25.0	11.7	7.8	220.2	186.8
Area Mean	13.5	12.1	15.0	13.2	193.3	152.6
	p = 0.06		p = 0.03		p < 0.01	

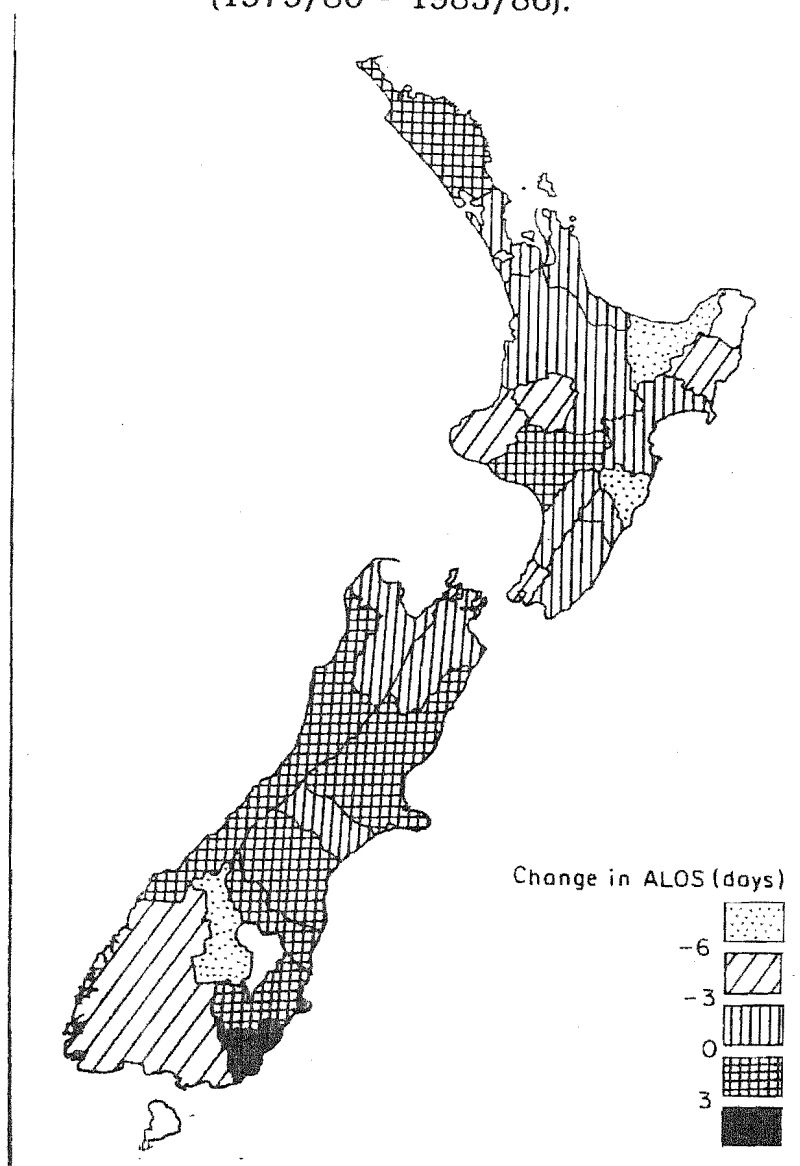
Otago. If hospitalization is regarded as a failure of early intervention or poor quality care in the community, increased morbidity levels and/or increased diabetes prevalence, then most concern must be shown for the residents of the small boards of Dannevirke, Taumaranui and Waitaki. These regions are not well served by diabetes services.

These three regions were not alone in having high rates of hospital discharge for diabetes at the end of the study period. Rather, the West Coast and South Canterbury, although improving substantially (initial highs of 27.8 and 22.3 per 10,000 respectively), still had high rates of hospital discharge at the end of the study period (19.7 and 15.7) (Table 7.5). These two areas have also been slow to introduce and develop diabetes services.

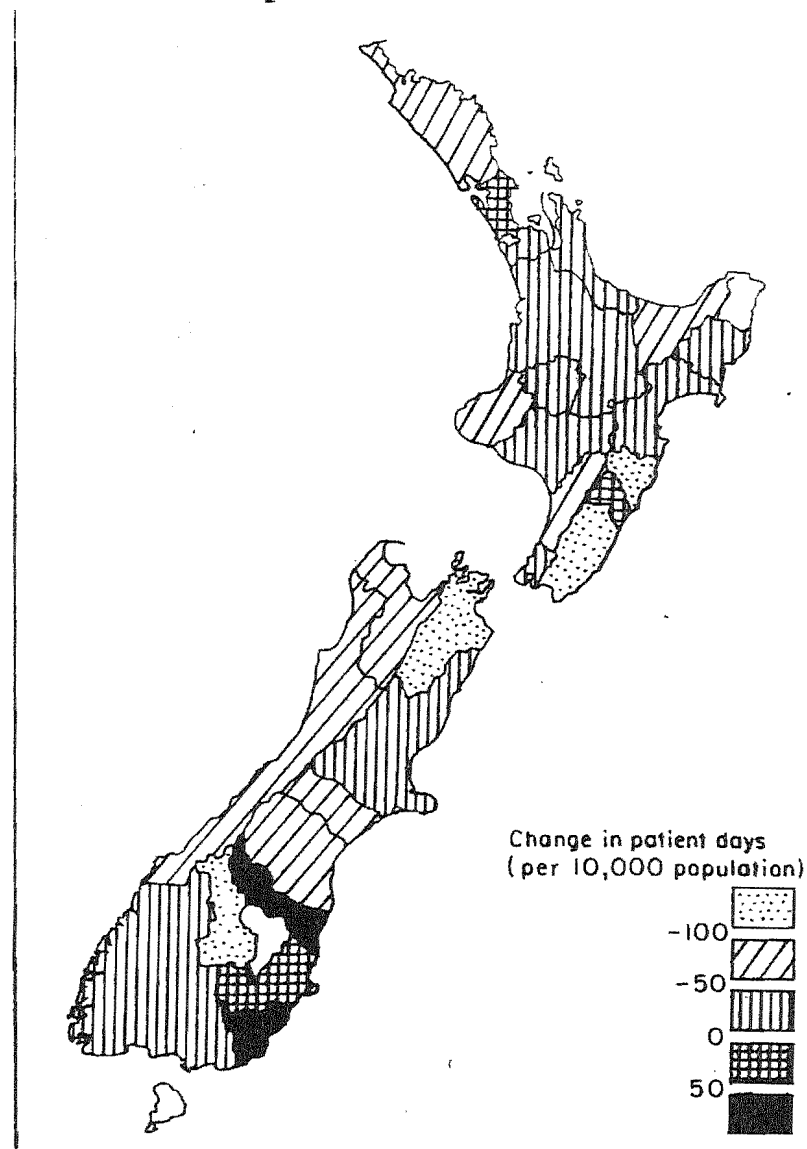
Rates of hospitalization dropped not only in areas with initial high rates of use but also in larger board regions which had relatively low rates in 1979/80. Palmerston North, Waikato and Canterbury had all introduced and promoted diabetes education from the outset of the study period.

Figures 7.24 and 7.25 illustrate spatial patterns in changes in both ALOS and total patient days per 10,000 (accompanying data are provided in Table 7.5). Overall, the total area mean ALOS dropped from 15 days in 1979 to 13.2 (paired t-test  $p < 0.05$ ) with 19 areas reducing their mean duration of hospital stay over the study period. Of the 8 areas not recording reductions in ALOS, 6 were located in the South Island. Only 5 areas experienced net gains in patient days per capita over the 8 years. In 1979/80 the mean area rate was

**Figure 7.24:** Changes in ALOS by Hospital Board Area (1979/80 - 1985/86).



**Figure 7.25:** Changes in Patient Days (Per 10,000 Population) Hospital Board Area (1979/80 - 1985/86).



measured at 193 days and this decreased significantly to 153 days by 1985/86 (paired t-test  $p < 0.01$ ). Hospital use increased most noticeably in South Otago and Waitaki where both ALOS and admissions to hospital increased.

Major reductions in total hospital use did occur in many board areas. Some 12 regional populations decreased their patient days spent in hospital for diabetes by over 25%. Most of the "second order" hospital board areas experienced sizeable reductions in hospital stay for diabetes. Northland, Nelson, Taranaki, South Canterbury, Southland and Wanganui, for example, all had reductions in per capita days stay greater than 35 days per 10,000 population.

## **7.6 SUMMARY**

Rates of hospital admission for diabetes increased rapidly in the 1960s and 1970s in New Zealand when increased demand was being placed on hospital services by the population at large. Diabetes discharges have stabilized in the 1980s, and this has coincided with, and may reflect in part, the introduction of diabetes patient education and community care initiatives.

There is little doubt that national trends in hospitalization for diabetes over time reflect the changing prevalence of the disorder in the community, especially non-insulin dependent diabetes. However, the lack of epidemiological data prohibits greater exploration of this as an explanation of these time trends. The increase in hospitalization of the Polynesian population is compared to hospital use by Europeans, arises largely through the dramatic increase in

diabetes prevalence in this ethnic group (Prior and Tasman-Jones, 1981).

However, patterns of hospitalization by sex and age breakdowns, and the parallels between diabetes and all causes of hospital admission, indicate the importance of hospital admission practices over and above diabetes morbidity in the community in explaining rates of hospitalization for diabetes.

Considerable variation occurs in patterns of diabetes hospitalization on a regional basis, particularly in rates of admission and to a lesser extent in average length of hospital stay. Spatial patterns in per capita discharge rates for diabetes reflect general trends in hospital use, with populations in the smaller rural hospital board areas making greater use of available hospital resources.

Changes in rates of hospital use over the eight year study period have not been consistent between area populations. A number of populations still have high rates of diabetes hospitalization which are two to three-fold greater than the rates recorded by populations living in the main urban boards.

Areas typically recording high hospital bed occupancy for diabetes are the smaller rural boards in which diabetes services are least developed but hospital bed supply is relatively high. Attention, thus, turns specifically to examining Roemer's Law and whether or not these spatial patterns in diabetes hospitalization can be accounted for by area variations in the availability of health care resources.



## **CHAPTER EIGHT**

### **DOES RESOURCE AVAILABILITY INFLUENCE AREA VARIATIONS IN DIABETES HOSPITALIZATION?**

#### **8.1 INTRODUCTION**

In Chapter Seven, per capita rates of hospitalization for diabetes were shown to vary considerably between hospital board districts. Small area studies indicate that hospital use can vary substantially between areas which on available indices have similar population characteristics and health needs, or that differences inherent in the area populations only partially explain the variations in rates of hospitalization (e.g. Roemer, 1961; Anderson, 1973; Kekki, 1980; Wennberg et al, 1982; Connell et al, 1984). Considerable variation remains even when demographic and socio-economic factors are controlled for. Empirical comparisons between areas have pointed to the importance of health system factors in determining people's access to hospital services and the resultant variations observed in hospital use.

The number of hospital beds used by a community is an outcome of the interaction that occurs between its demand for hospital care and the supply of health care resources both within and outside the hospital sector. Patterns of hospitalization, like those described in the previous chapter reflect the combined effects of

possible differences in the characteristics of area populations, disparity in the provision and operation of local health services, and random variation due to chance effects in the hospitalization process (Willemain, 1982). The aim of this chapter is to tease out the importance of these effects in explaining the patterns of diabetes related to hospitalization identified in Chapter Seven.

In particular, the following analysis examines the relationship between the availability of medical care and area rates of diabetes hospitalization. It aims to test the applicability of "Roemer's Law" to diabetes via the following steps; first it will attempt to uncover the relationship between per capita rates of diabetes hospitalization and area hospital bed supply; secondly, the applicability of Roemer's Law in the context of other medical resources will be examined in order to ascertain whether or not the availability of doctors, both general practitioners and hospital based specialists also influence hospital use; and thirdly, the chapter will attempt to determine whether or not regional variations are in fact due to legitimate differences in the needs of the hospital board populations.

The logic behind the investigation is that population based rates of hospitalization should be uniform for well-matched population groups, or when differences in socio-demographic factors are controlled for. Area based equity implies medical resources, such as hospital beds or doctors, are provided in accordance with levels of need (Cardwell, 1964; Sweeney and Ashley, 1981; Smith and Sutton, 1984).

The approach adopted in the analysis is based on the arguments of the preceding chapters. Hospital use is seen as a function of two sets of variables, those representing the socio-demographic characteristics of the hospital board populations and those representing the supply of medical resources available to each area's population. Methods used are not dissimilar from those used by other researchers investigating health services utilization with respect to variations in the availability of medical care (Anderson, 1973; Harris, 1975; Martini et al, 1977; Kekki, 1980; Gornick, 1982; Dutton, 1986).

An empirical model is developed based on a priori theoretical and substantive considerations and bivariate and multivariate analyses are used to determine the relative influence of socio-demographic and resource measures on diabetes hospital use. Correlation and multiple linear regression techniques are useful methods for exploring problems like hospital utilization where there are many possible factors affecting the phenomenon under study. The data on diabetes hospitalization are those identified and described in the previous chapter. Details and explanation of the database and units of analysis are given in Section 7.4 of Chapter Seven.

This chapter is structured into three main sections. Methods and specification of the model are outlined next in Section 8.2. Results are presented in two sections: the first set of findings report the basic relationships that exist between selected predictors of use and the outcome measures. The best predictors of diabetes hospitalization are identified; and Section 8.4 then examines the relative importance of the supply of resources or "provider" factors

versus socio-demographic or "need" factors in explaining area variations in diabetes hospitalization.

## 8.2 METHODS AND MODEL SPECIFICATION

The interrelationships expected to occur between different predictors of use and the manner in which they may directly or indirectly affect rates of hospitalization can be made explicit through multiple regression modelling. Regression identifies the relative effects of independent variables on the chosen measures of hospital use and provides estimates of the magnitude of these relationships (Draper and Smith, 1966; Sokal and Rohlf, 1969; Yeates, 1974). The regression model takes the following format:

$$H = f(p_1 \dots p_m; S_1 \dots S_n) + \varepsilon$$

where:     H is rates of hospitalization, e.g. per capita discharges,  
               patient days or ALOS;  
                $p_1 \dots p_m$  are area population characteristics 1 to m;  
                $S_1 \dots S_n$  are health service system factors 1 to n;  
 and:         $\varepsilon$  is error term.

Area rates of diabetes hospitalization are thus seen as a joint function of the population characteristics of the hospital board areas and the availability of health care resources. A residual term may exist through non-inclusion of important determinants of use or through the effect of random variation in diabetes hospitalization. Seven independent variables define community need in terms of the demographic and socio-ecological characteristics of the board

populations. Five variables represent variations in the availability of medical care.

### **8.2.1 Dependent Variables**

Three measures of hospitalization are investigated. These are diabetes discharges per 10,000 area population, patient days per 10,000 population and ALOS (average length of stay). The derivation and explanation of these outcome variables are given in Section 7.4 of the previous chapter. The data are common to both chapters. The study period is again the eight years 1979 to 1986 inclusive.

### **8.2.2 Independent Variables - Area Population Attributes**

Area populations contribute to variations in hospital use through variations in the occurrence of illness and individual behaviour in seeking hospital care. Seven key variables were selected as indicators of an area's need for hospital care, the population's predisposition to using hospital services and their ability to obtain that care. These factors are:

AGE1	% area population aged 45-64 years
AGE2	% aged 65 or more years
F	% female
P	% Polynesian
SMR	standardized mortality ratio
E	% area population aged 15 years and above with tertiary education qualifications
and: I	median income of males aged 15 years or more

Choosing the most relevant demographic, social and economic variables is problematic. These seven factors were selected on an a priori basis, taking into account the results of Chapter Seven and evidence presented in the literature as to the most important individual predictors of hospital use.

Together these variables define the social structure of each area, but equally importantly they act as proxy variables for the prevalence of diabetes and diabetes-related morbidities, in the absence of data on diabetes epidemiology. However, as pointed out in Chapter Five, demographic and lifestyle factors are strong aetiological forces in diabetes, and can therefore be used as surrogate measures of diabetes prevalence. Furthermore, standardized mortality ratios are included as an overall indicator of health status. It is postulated that areas with poor health status as represented by excessive levels of mortality relative to the country as a whole, will also have high levels of diabetes morbidity. That is, the processes giving rise to high death rates, may also be those relating to diabetes.

Data for each variable, excluding SMR, were extracted from New Zealand censuses of population and dwellings (three major sources are identified in Section 7.4). The SMR's were derived from data obtained from the NHSC annual publication series "Mortality and Demographic Data". The precise definitions of these variables, problems with the data, and methods used in calculating area values, are detailed in the technical notes in Appendix D.1. SMR data were available for each individual year, with the exception of 1986. The

other six variables were anchored on the 1981 and 1986 census data, with values being interpolated for inter-census years.

The 27 hospital board areas under study do vary in their population characteristics. Regional comparisons are summarized in Table 8.1 which provides descriptive statistics for each of the seven socio-demographic variables at the start and conclusion of the study period. Coefficients of variation are greatest for P and AGE2, indicating the board populations differ most with respect to their ethnic composition and the proportion of elderly residents. Both of these variables are important factors in diabetes. Levels of tertiary education also differed noticeably at the start of the study period, and although remaining spatially disparate, areas have converged slightly over time. Median income (I) has nearly doubled, but the relative differences between area populations have not changed.

### **8.2.3 Independent Variables - Variations in Medical Care**

The supply of medical resources available to an area population is divided into four components:

- (1) Hospital bed supply;
  - (2) Availability of medical specialists in non-administrative public hospital practice;
  - (3) Availability of general practitioners,
- these are expressed as per capita rates (per 10,000 population) and are represented in the regression analyses by the variables BEDS (or ABEDS), SS and GPS respectively; and

**TABLE 8.1**  
**SOCIO-DEMOGRAPHIC VARIABLES:**  
**MEAN, STANDARD DEVIATION AND RANGE**

Variable		Mean	Standard Deviation	Range
AGE1	1979	18.66	1.20	16.15-20.59
	1986	18.53	1.17	16.66-21.18
AGE2	1979	9.88	1.74	5.68-12.91
	1986	10.85	1.83	7.38-13.90
F	1979	49.75	0.88	48.25-51.25
	1986	49.86	0.94	47.76-51.50
P	1979	10.31	8.87	1.16-34.82
	1986	14.59	10.04	3.10-40.30
SMR	1979	0.992	0.104	0.691-1.204
	1985*	1.031	0.085	0.896-1.220
E	1979	24.03	5.11	17.57-39.79
	1986	29.23	2.89	25.28-37.70
I	1979	7.7	0.59	6.8-9.3
	1986	14.3	1.20	12.5-18.1

\* 1986 data unavailable.

Note: See text for definitions of variables.



- (4) Provision of specialist diabetes ambulatory services, which is operationalized through two dummy variables D1 and D2.

Details and explanations of these resource factors are given in the Technical Notes accompanying this chapter (Appendix D.1). Specification of these variables was problematic and several points on their derivation and meaning will be discussed here.

Firstly, cross-boundary travel is a feature of hospital care in New Zealand (NHSC, 1983). While this does not affect the area hospitalization rates which are based on patient domicile, inter-board travel does impact on the hospital bed supply that is effectively available for use by each area population. All figures used in the analyses on bed supply have therefore been adjusted for cross-boundary flow. This topic is discussed in Appendix D.2. Patterns of cross-boundary travel for diabetes hospitalization are identified, and the procedure used in adjusting area availability of hospital beds is outlined. The method follows that established by Barnes (1982).

In essence, all hospital beds are allocated on a per capita basis. The total number of beds available to the population of an area is the sum of that area's bed supply that is normally used by local residents plus the number of beds provided by other hospital boards that are used by travellers from the area. Allocation of out-of-board domiciliary beds to an area depends upon the stability of cross-boundary patterns in terms of both discharge numbers and length of hospital stay.

Two bed supply variables were calculated, BEDS and ABEDS. The former includes medical, surgical, paediatric and geriatric beds, and is adjusted for cross-boundary travel on the basis of patient days stay. BEDS is used in relation to the discharge data which pertains to all diabetes discharges irrespective of length of hospital stay (see Section 7.4). It is appropriate therefore to adjust according to the level of total demand placed on hospital services.

The second bed supply variable ABEDS is used as the independent variable in the analyses involving hospital stay where the very long stay admission events have been removed from the database (see Section 7.4). ABEDS included medical, surgical and paediatric beds. Geriatric beds were omitted as most discharges in the days stay database would not have involved this bed type. Adjustment for inter-board flows was on the basis of discharge numbers rather than patient days. Details are given in Appendix D.2.

Secondly, problems were encountered in obtaining comparable data over the eight year study period on the supply of medical practitioners by hospital board area. Data on area availability of specialists and general practitioners are collected by the Medical Council, and published in the New Zealand medical work-force statistics series. Data relevant to this study were first available for 1980, and although information could be obtained up to 1985, the data were not always consistent between years.

For example, although the number of general practitioners in each board area could be determined for each year from 1980 to 1985 inclusive, their full-time equivalents could not. While full-time

equivalents are more indicative of the real availability of primary medical care, because data was available for an insufficient number of years, the total number of doctors practising in each area was therefore used as an indicator of the availability of primary care. The variable SS was, however, based on full-time equivalents. This is important because specialists, more so than general practitioners, divide their time between multi-work functions. SS measures the availability of specialists solely in terms of their time spent in non-administrative public hospital practice. For both these supply variables the 1980 data were used for 1979 and 1985 for 1986.

Thirdly, the fourth component in the set of resource factors is the availability of ambulatory-based diabetes services. There are two aspects to this, the provision of diabetes outpatient clinics and the provision of diabetes educational services (usually in the form of diabetes nurse educators and dietitians). Areas were classified each year into one of three categories according to the provision of services and their state of development. These are:

- (1) Areas where both educational and outpatient services are operating in an established organizational format;
- (2) Areas with only one ambulatory component, usually the employment of a diabetes nurse educator, or where both clinic and educational services are available but with one only recently introduced and not well developed; and
- (3) Either no diabetes service exists, or the diabetes nurse educator is a new appointment and her (or his) services are provided on a limited basis.

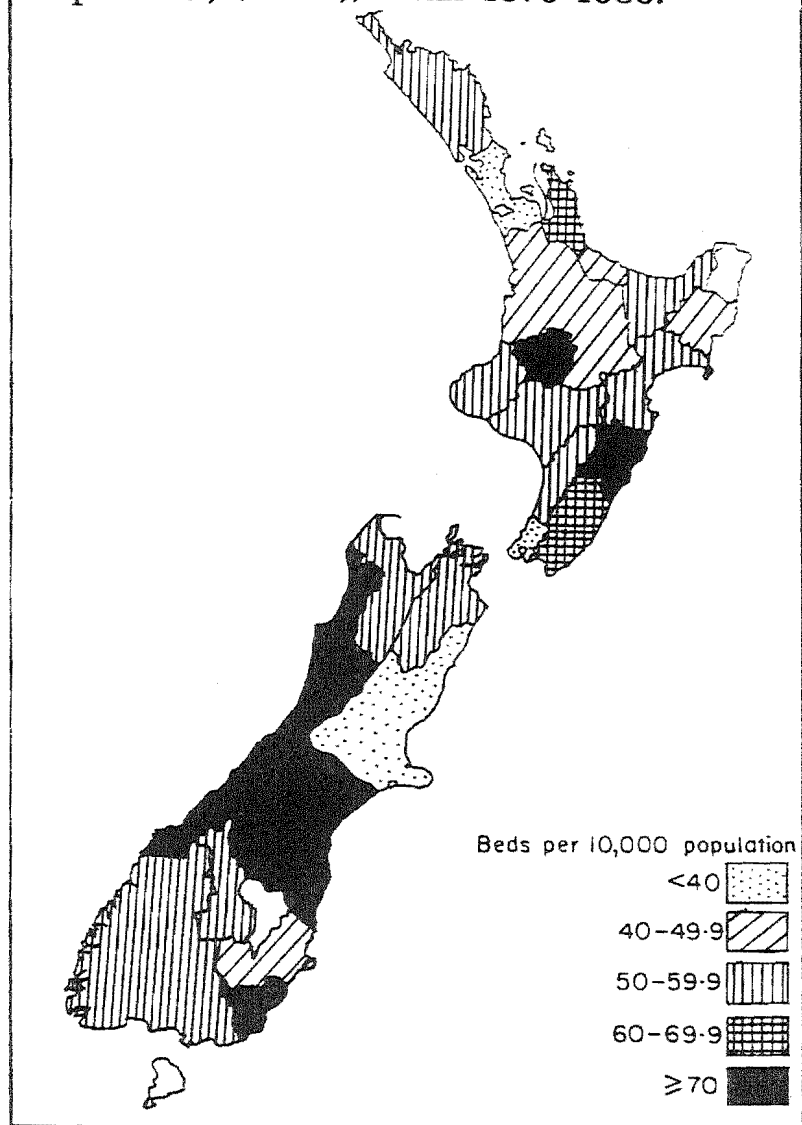
Information on the provision and development of diabetes services in each area was gleaned from the New Zealand Society for the Study of Diabetes, from personal knowledge of the areas, but particularly through contact with local health workers, especially diabetes nurse educators.

This factor on the availability of ambulatory diabetes services was operationalized in the regression models through two dummy variables D1 and D2. Dummy variables are assigned a value of 0 or 1 depending upon whether or not an observation has a particular attribute (Draper and Smith, 1966; Yeates, 1974). In this case D1 defines category 1 (good service provision) and D2 category 2 (some services). An area will score 1 for D1 if it falls into category 1 and 0 if it does not. Similarly, if an area is classified as category 2 then D2 = 1, and 0 if it does not. Since these are mutually exclusive categories, all areas with no specialist diabetes services are defined through the delimitation of categories 1 and 2. Thus, diabetes service categories have the following values:

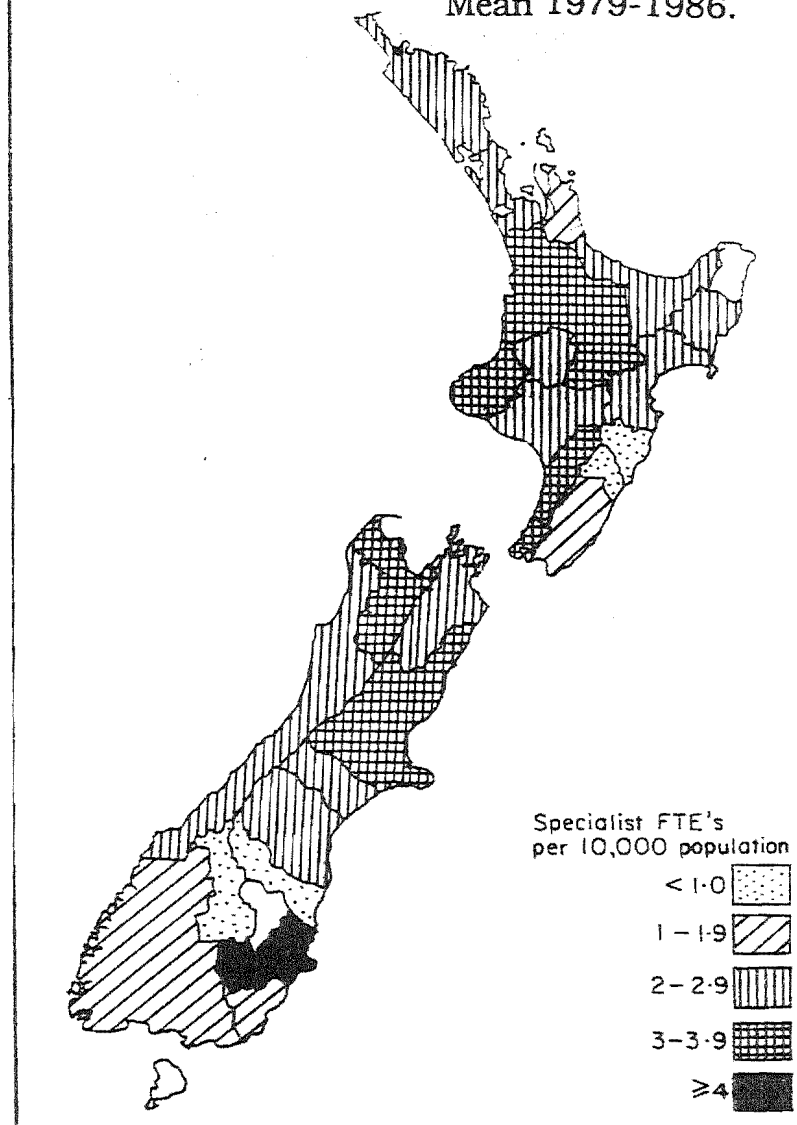
category 1	D1 = 1, D2 = 1	both services
category 2	D1 = 0, D2 = 1	one service
category 3	D1 = 0, D2 = 0	none (or very limited)

The spatial variability of these resource factors is shown in Figures 8.1 to 8.4. The distributions pertain to levels of supply averaged over the eight years. The hospital bed supply is for BEDS, but the adjusted supply excluding geriatric beds (ABEDS) reflects the pattern shown in Figure 8.1. Basic descriptive statistics are provided in Table 8.2.

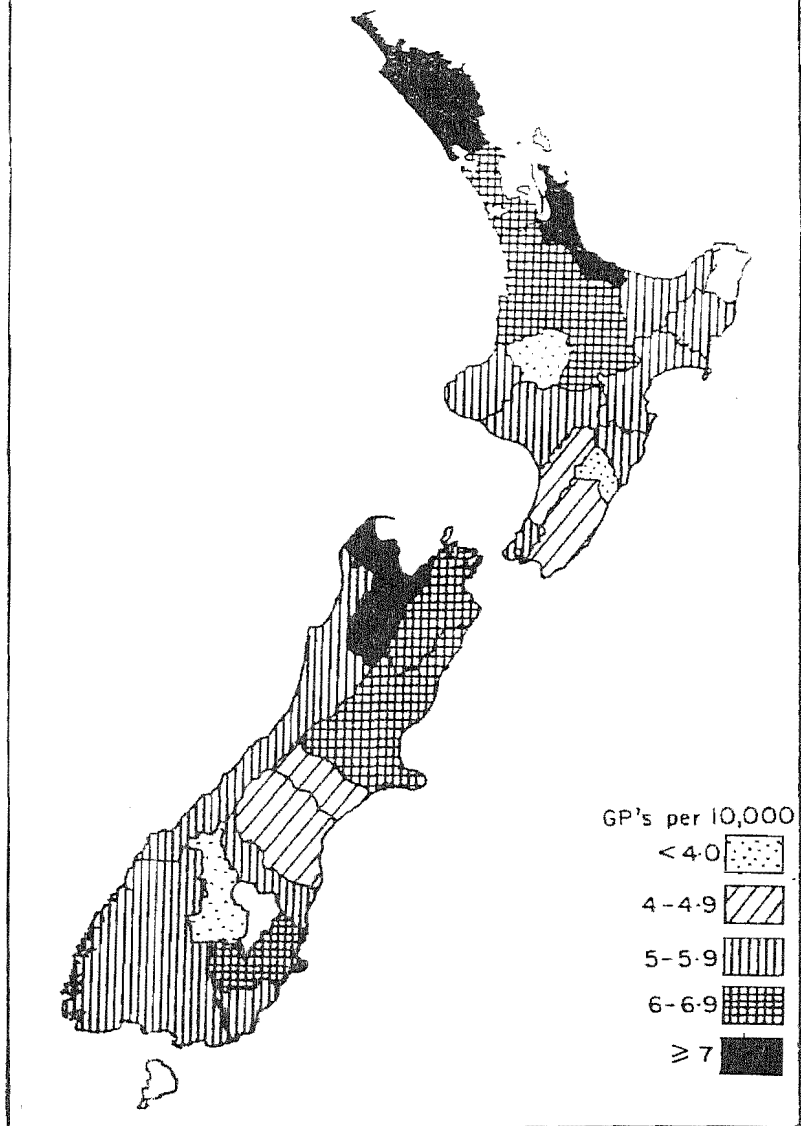
**Figure 8.1:** Effective Hospital Bed Supply (Per 10,000 Population) (BEDS), Mean 1979-1986.



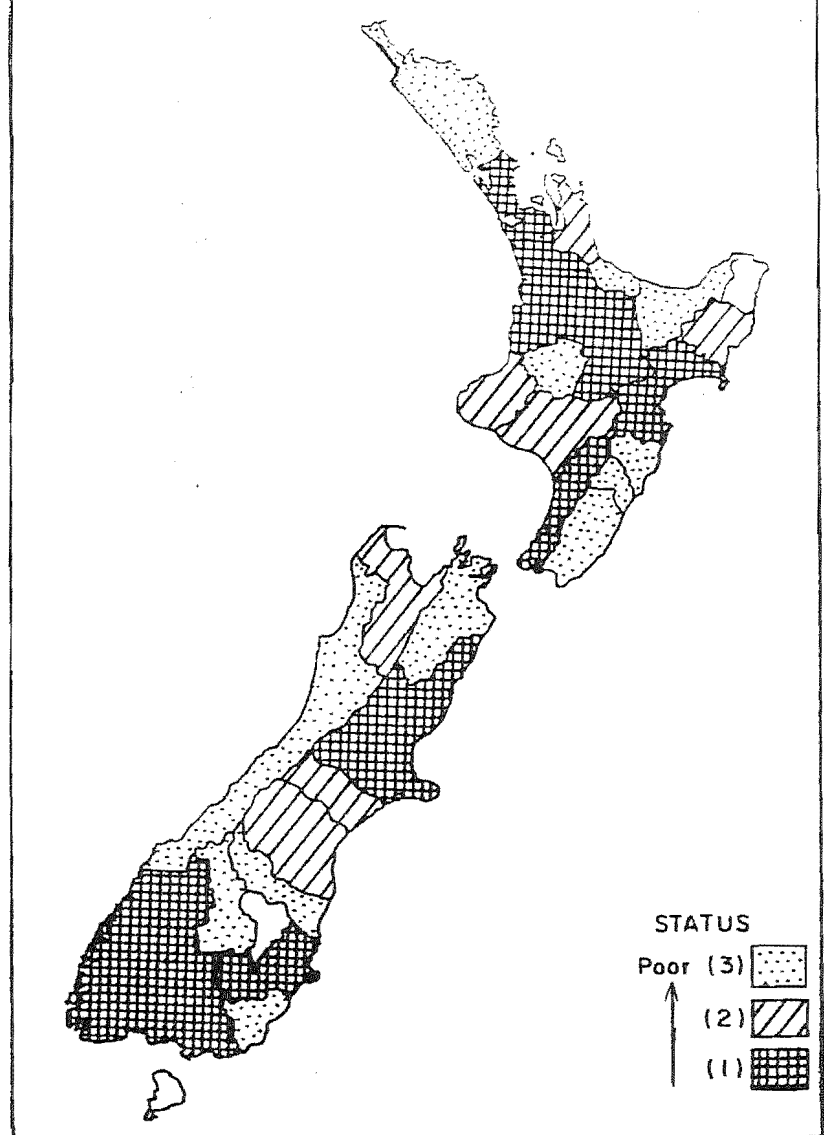
**Figure 8.2:** Supply of Public Hospital Specialists (Full-Time Equivalents in Non-Administrative Practice), Mean 1979-1986.



**Figure 8.3:** Per Capita Availability of General Practitioners  
Mean 1979-1986.



**Figure 8.4:** Provision of Ambulatory Diabetes Services  
(Mean 1979-1986).



**TABLE 8.2**  
**AVAILABILITY OF MEDICAL RESOURCES:**  
**MEAN, STANDARD DEVIATION, RANGE**

Variable		Mean	Standard Deviation	Range
BEDS	1979	63.69	17.12	33.00-95.30
	1986	55.60	15.39	27.40-89.40
ABEDS	1979	48.96	13.92	26.90-78.00
	1986	38.77	9.31	21.80-63.20
GPS	1980	5.36	1.07	4.03-7.57
	1985	5.94	1.21	3.12-8.55
SS	1980	2.27	1.00	0.00-4.73
	1985	2.35	1.12	0.00-4.61
D1	1979	0.22	0.42	0.00-1.00
	1986	0.44	0.50	0.00-1.00
D2	1979	0.11	0.32	0.00-1.00
	1986	0.30	0.47	0.00-1.00

Note: See text for definitions of variables.

Clearly, there is considerable differentiation in the availability of medical care between the 27 hospital boards included in the study. Spatial disparities in the supply of hospital beds appears to have decreased over time while the reverse seems to be true of general practitioners and specialists. The regional provision of diabetes ambulatory services has also improved.

No variables were included on costs of care because public hospital services are provided free of charge, as are outpatient diabetes services. These are also operated by the local hospital boards (Chapter Six). For the reasons specified in Chapter Six, medical insurance coverage is also of little consequence in this analysis. While costs involved in attending general practitioners may very well differ throughout the country, no data is available to adjust for this potential barrier to primary care, and it is difficult to predict the extent to which this would influence diabetes hospitalization.

Roemer's effect of resource availability on hospital use can be estimated from the regression coefficients for the resource variables in the regression models (Ginsburg and Koretz, 1983). It is important to take into account differences in area population characteristics in this modelling procedure. Omission of important socio-demographic factors may bias the magnitude of the effect of Roemer's law upwards.

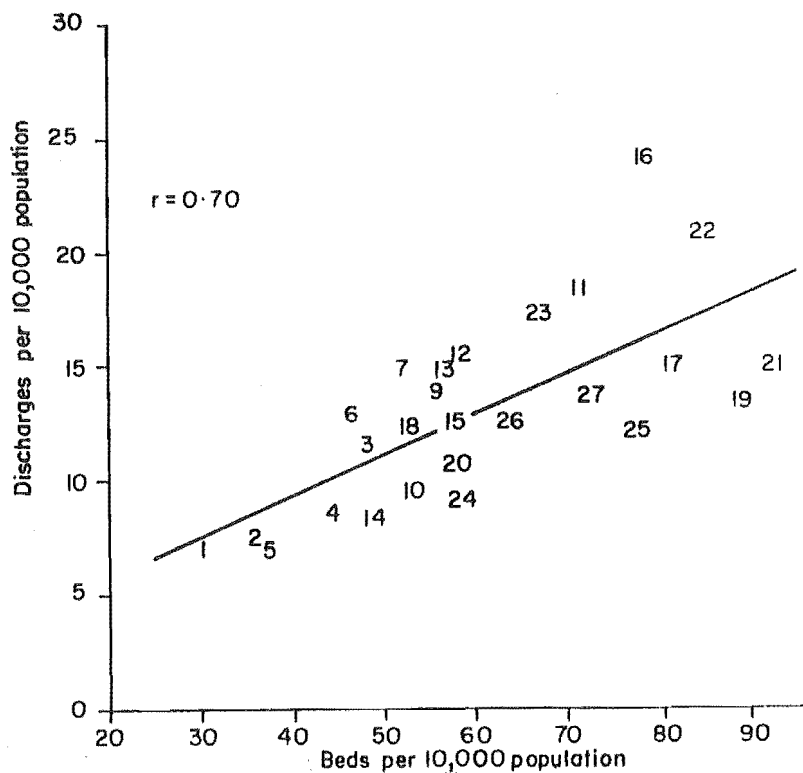


### 8.3 AREA VARIATIONS IN DIABETES HOSPITALIZATION AND PREDICTORS OF USE

A comparison of Figure 8.1 with 7.14 and 7.21 suggests a possible spatial correlation between hospital bed supply and hospital utilization for diabetes. The relationships between BEDS and diabetes discharges per 10,000 area population, and ABEDS and patient days per 10,000 for the means of the areas' annual values are shown in Figures 8.5 and 8.6. These confirm that rates of diabetes hospitalization tend to be higher in areas with a higher per capita availability of hospital beds. Areas with increased bed supply have higher discharge numbers and patient days stay. Contrast Taumaranui, the West Coast or South Otago with Auckland, Canterbury or Wellington for example (Figures 8.5 and 8.6).

The zero-order correlation coefficients between the socio-demographic and resources variables and two of the three measures of hospital use are shown in Table 8.3. Only values that are significant at  $p < 0.10$  are given. ALOS was not included as it related poorly with all the predictor variables. Several points emerge from this table.

First, per capita rates of diabetes discharges and patient days stay were most highly correlated with hospital bed supply. This was evident in the average annual rates of hospital use, but also in 5 of the 8 years studied for discharges and 3 of the 8 years in the case of patient days stay. Only in 1983 was bed supply not significantly related to the frequency of diabetes discharges, a year noted nationally as having a high per capita discharge rate. Bed supply was not correlated with days stay, in 1985 only.

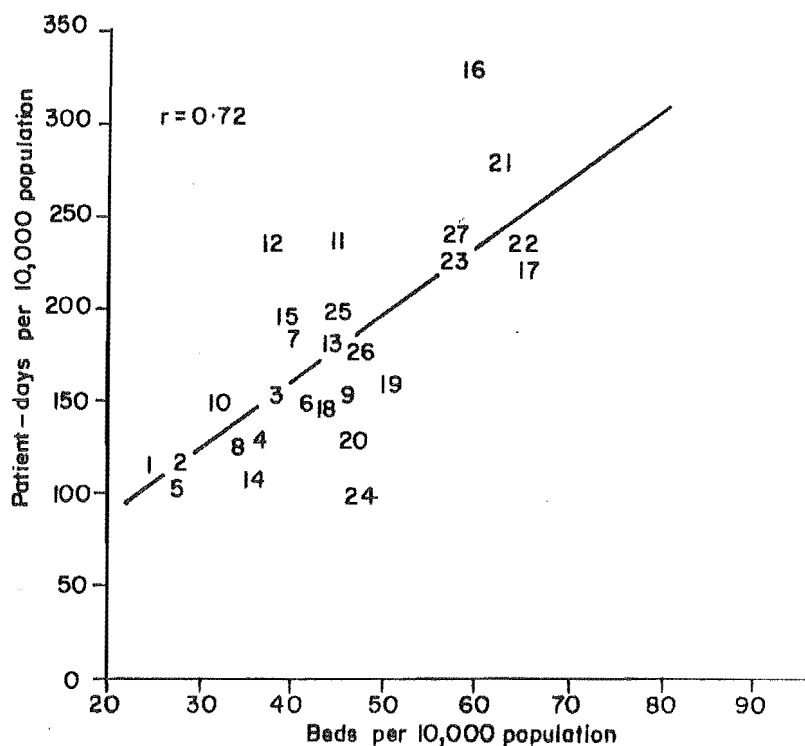


**Figure 8.5:**

Relationship Between Bed Supply (BEDS) and Area Discharge Rates for Diabetes (Discharges Per 10,000 Population), Mean Data 1979-1986.

# KEY

- 1 Auckland
- 2 Canterbury
- 3 Otago
- 4 Waikato
- 5 Wellington
- 6 Cook
- 7 Hawke's Bay
- 8 Nelson
- 9 Northland
- 10 Palmerston North
- 11 South Canterbury
- 12 Southland
- 13 Taranaki
- 14 Tauranga
- 15 Wanganui
- 16 West Coast
- 17 Ashburton
- 18 Bay of Plenty
- 19 Dannevirke
- 20 Marlborough
- 21 South Otago
- 22 Taumarunui
- 23 Thames
- 24 Vincent
- 25 Waipawa
- 26 Wairarapa
- 27 Waitaki



**Figure 8.6:**

Relationship Between Bed Supply (ABEDS) and Area Rates of Hospital Stay for Diabetes (Patient Days Per 10,000 Population), Mean Data 1979-1986.

TABLE 8.3

**ZERO ORDER CORRELATION COEFFICIENTS BETWEEN DIABETES  
HOSPITALIZATION AND AREA POPULATION CHARACTERISTICS  
AND THE SUPPLY OF MEDICAL RESOURCES**

**(a) Discharges Per 10,000 Population**

Variable	1979	1980	1981	1982	1983	1984	1985	1986	Mean Data 1979-1986
AGE1									
AGE2									
F	-.340	-.493	-.414	-.385			-.382	-.400	-.446
P									
E	-.406	-.445	-.606	-.593	-.583	-.490	-.490	-.697	-.629
I	-.366	-.342				-.334		-.463	-.380
SMR		.330							.428
BEDS	.483	.576	.758	.434		.546	.603	.647	.695
SS			.469						
GPS			-.475				-.414	-.407	
D1	-.396	-.378	-.464	-.421					-.431
D2									

**(b) Patient Days Per 10,000 Population**

Variable	1979	1980	1981	1982	1983	1984	1985	1986	Mean Data 1979-1986
AGE1									
AGE2									
F	-.431	-.456	-.475	-.434					-.450
P									
E	-.409	-.368	-.445	-.551	-.535	-.483	-.424	-.501	-.620
I						-.397		-.360	-.323
SMR		.353							.443
ABEDS	.431	.500	.646	.575	.524	.416		.393	.719
SS				-.521					
GPS			-.501						
D1	-.480		-.340						-.324
D2									

Note: (N = 27, DF = 25),  $p < 0.01$ ,  $r > 0.323$ ;  $p < 0.05$ ,  $r > 0.381$ ;  $p < 0.01$ ,  $r > 0.487$ .

Second, although the relationships were not evident over the whole study period, the simple correlations between the supply of general practitioners (GPS) and the supply of ambulatory diabetes services (D1) with discharges from hospital do suggest the presence of an inverse relationship between the availability of ambulatory medical care and rates of admission to hospital. In 1981, 1985 and 1986, areas with more general practitioners had significantly fewer diabetes discharges per capita.

The provision of diabetes services (D1) was correlated with hospital use up to 1983. Only the eight large hospital boards (see Figure 8.4) had well established diabetes outpatient clinics, and all had introduced and developed educational based programmes prior to 1983. These areas averaged 10.1 discharges per 10,000 population per annum between 1979 and 1982, compared to 14.7 in the 19 areas with few or no services (categories 2 or 3). Since 1983 many other hospital boards have extended their provision of diabetes services. Thus over time, more areas have come into the service categories 1 or 2. While the better served areas have maintained a comparative advantage in fewer admissions the statistical difference in hospital use rates has weakened as additional areas improved local diabetes service provision.

Third, apart from bed supply, rates of diabetes hospitalization are only consistently and significantly associated with the educational level of the board populations (E). The direction of this relationship would indicate that area populations that have relatively higher levels of educational attainment have fewer admissions to hospital for

diabetes and lower days stay per capita. The variables E and F, representing the sex ratio of the area populations, appear to be the two key socio-demographic predictors of in small area variations in diabetes hospitalization.

Both hospital use ratios are inversely related to the proportion of females in an area. This is not interpreted as males being more prone to hospitalization, rather, areas that have more males in their populations, have higher per capita rates of diabetes hospitalization overall.

Fourth and rather surprisingly, three of the socio-demographic variables conceptually seen as important determinants of hospital utilization rates, the proportion of an area's population that is middle-aged (AGE1), the proportion aged 65 years or over (AGE2), and P representing ethnic composition in terms of the percentage of an area's population that are Polynesian, were not correlated with any of the three measures of diabetes hospitalization. This may reflect scale effects (Gornick, 1982) in that age and ethnic differences in the occurrence of diabetes are not represented sufficiently by overall differences in aggregate data. Additionally, only when the data was smoothed over the eight year study period did SMR, indicating the general health status of each area relative to the others, emerge as a covariant. While not attaining significance at  $p < 0.01$ , the correlation coefficients for SMR did show diabetes hospitalization over the eight years was, on average, higher in areas that had excessive levels of mortality. Many of the variables representing area "need" for hospital care were thus, not or only weakly associated with diabetes related hospital use at this level of analysis.

A series of step-wise regressions were produced to identify the best predictor set of independent variables for each year for each of the three dependent measures of hospital use. The results of these are given in Table 8.4. Again the results for ALOS are not included because variables were entered into the regression if they were significant at  $p \leq 0.05$ . For ALOS, this condition was met only in 1980 for variable I, and in 1982 and 1986 for SS. These explained 33%, 14% and 15% of the total variation in mean stay between the 27 hospital board districts in these three years. Given the overall lack of explanatory power, variation within each annual dataset, and between years, no meaningful interpretation of these observations on ALOS can be made.

Table 8.4 confirms that the most important predictors of rates of diabetes hospitalization are an area's bed supply, level of education, and the supply of hospital-based specialists. With the entry criterion set at  $p \leq 0.05$ , no secondary variables were entered into 8 of the 9 regression models for diabetes discharge rates. Thus, bed supply and education, having the highest zero-order correlations were the best predictors, explaining on their own between 23 and 58% of the variation in the annual area rates of hospital discharge. In 1985, however, both SS and P had significant partial correlations with discharge rates after eliminating the effects of bed supply for SS (partial  $r = 0.401$ ), and BEDS and SS for P (partial  $r = 0.414$ ). Both factors positively influenced area hospitalization rates.

Over the eight year study period, the effective availability of hospital beds (BEDS) accounted for 48% of the variation in area's

**TABLE 8.4**  
**STEPWISE REGRESSIONS WITH ALL INDEPENDENT**  
**VARIABLES FREE TO ENTER**

**(a) Discharges Per 10,000**

Year	Step Entered At	Variable	Regression Coefficient	t-Value	R <sup>2</sup>
1979	1.	BEDS	0.15	2.76	0.23
1980	1.	BEDS	0.16	3.53	0.33
1981	1.	BEDS	0.18	5.81	0.58
1982	1.	E	-0.65	-3.68	0.35
1983	1.	E	-0.55	-3.59	0.34
1984	1.	BEDS	0.19	3.25	0.30
1985	1.	BEDS	0.33	5.30	(0.36)
	2.	SS	2.19	2.59	(0.47)
	3.	P	0.18	2.18	0.56
1986	1.	E	-1.07	-4.86	0.49
Mean Data					
1979-1986	1.	BEDS	0.18	4.84	0.48

**(b) Patient Days Per 10,000**

Year	Step Entered At	Variable	Regression Coefficient	t-Value	R <sup>2</sup>
1979	1.	D1	-87.68	-2.74	0.23
1980	1.	ABEDS	2.18	2.85	0.25
1981	1.	ABEDS	4.22	3.63	(0.42)
	2.	GPS	-32.83	-2.23	0.52
1982	1.	ABEDS	3.87	3.51	0.33
1983	1.	E	-9.93	-3.63	(0.29)
	2.	P	-2.62	-2.07	0.39
1984	1.	E	-12.06	-3.79	(0.23)
	2.	SS	26.20	2.35	0.38
1985	1.	E	-10.07	-2.34	0.18
1986	1.	E	-18.12	-3.73	(0.25)
	2.	SS	24.94	2.14	0.37
Mean Data	1.	ABEDS	3.00	4.53	(0.52)
1979-1986	2.	SMR	302.46	2.80	(0.59)
	3.	P	-1.72	-2.09	0.65

**Notes:**

- (1) F to enter or remove = 4; all variables entered in the models are significant at  $p \leq 0.05$ .
- (2) Regression coefficients and t-values are after all valid variables have entered.
- (3) (R<sup>2</sup>) are proportions of the total variation explained by the regression model at that step.

mean annual rates of hospital discharge for diabetes. The regression coefficient between bed supply per 10,000 area population and discharges per 10,000 was 0.18.

Bed availability (ABEDS) was also the best predictor of the area mean annual rates of patient days but with standardized mortality ratios and ethnic composition (P) also contributing significantly to the level of explanation. Together these three factors explained 65% of the variation in patient days stay for diabetes. The estimate of Roemer's effect from this model is 3.00, that is, an increase in bed supply by 10 beds per capita leads to an increase of 30 days stay in hospital per 10,000 population.

In four of the eight years, the regression models for patient days did progress to the second step. Of the four variables entered, three were factors of supply (Table 8.4). In 1984 and 1986, hospital stay was best predicted by an area's level of education and their supply of hospital based specialists. Thus, in these two years, the supply of specialists within the hospital system positively influenced hospitalization rates. In 1981, when the supply of general practitioners entered the regression along with hospital bed supply, over 50% of the variation was explained. Hospital use was inversely related to the availability of doctors in primary care.

#### **8.4 RESOURCES VERSUS SOCIO-DEMOGRAPHIC FACTORS**

The above results identify bed supply and the educational level of an area population as the best individual predictors of area rates of



diabetes hospitalization. The aim of this section is to tease out the independent effects of resources compared to socio-demographic factors in explaining the area variations in hospital use observed in Chapter Seven.

However, a problem exists in these analyses which affects the interpretation of the importance of both the resource and "need" factors. This is the multi-collinearity that exists between an area's level of education (E) and the other independent variables, especially those measuring the availability of medical resources. The correlation matrix for the area annual data averaged over the eight year study period is given in Table 8.5. Only those coefficients that are significant at  $p \leq 0.05$  are listed.

Keeping this in mind, the independent contribution of the resource and socio-demographic sets of variables to area variations in diabetes hospitalization can be examined by using multiple regression analyses to partition the variance in each dependent measure between the two sets of explanatory variables. The method is an adaptation of that described by Mood (1971) and used by Martini et al (1977). The first step in the analysis used stepwise regressions to identify the best socio-demographic predictors, and the best predictors from the resource variables for both discharges and patient days for each of the data runs (ALOS was not investigated because of the lack of association with the explanatory variables). Only those variables significant at  $p \leq 0.05$  were entered into the models. These best predictors and the proportion of variation they explained in the two dependent variables are shown in columns a and c of Table 8.6. Thus, in 1979, for example, E was the only significant

**TABLE 8.5**  
**CORRELATION MATRIX FOR THE INDEPENDENT VARIABLES**  
**USED IN THE REGRESSION MODELS FOR AREA ANNUAL DATA**  
**AVERAGED OVER THE PERIOD 1979 TO 1986**

Variable	AGE1	AGE2	F	P	E	I	SMR	BEDS	ABEDS	SS	GPS	D1	D2
AGE1	1.000												
AGE2	0.846	1.000											
F		0.449	1.000										
P	-.650	-.679		1.000									
E			0.462		1.000								
I	-.452	-.497			0.507	1.000							
SMR	-.490				-.434		1.000						
BEDS			-.627		-.720	-.473	0.442	1.000					
ABEDS			-.642		-.688	-.421		0.869	1.000				
SS			0.634		0.573		-.423	-.545	-.495	1.000			
GPS	0.513				0.392		-.414			0.458	1.000		
D1			0.530		0.615	0.504		-.631	-.662	0.516		1.000	
D2							0.428					-.384	1.000

**Note:** All correlations significant at  $p \leq 0.05$

TABLE 8.6

**THE SENSITIVITY OF AREA RATES OF DIABETES  
HOSPITALIZATION TO THE AVAILABILITY OF MEDICAL CARE  
AND AREA POPULATION CHARACTERISTICS**

**(a) Discharges Per 10,000**

Best Socio-Demographic Predictors			Additional R <sup>2</sup> Explained Uniquely by Resources		Best Resource Predictors		Additional R <sup>2</sup> Explained Uniquely by Sociodemographics	
Year	Variables (a)	R <sup>2</sup>	Variables (b)	ΔR <sup>2</sup>	Variables (c)	R <sup>2</sup>	Variables (d)	ΔR <sup>2</sup>
1979	E	.17	-	-	BEDS	0.23	-	-
1980	F,I	.39	SS,GPS	0.29	BEDS	0.33	-	-
1981	E,P	.48	BEDS	0.13	BEDS	0.58	-	-
1982	E	.35	-	-	BEDS	0.19	E	0.17
1983	E	.34	-	-	-	-	-	-
1984	E	.24	-	-	BEDS	0.30	-	-
1985	E	.24	BEDS,SS	0.24	BEDS,SS	0.47	P	0.09
1986	E	.49	-	-	BEDS	0.42	E	0.11
M.D.								
1979-86	E	.40	BEDS,SS	0.21	BEDS	0.48	-	-

**(b) Patients Days Per 10,000**

Year	Variables (a)	R <sup>2</sup>	Variables (b)	$\Delta R^2$	Variables (c)	R <sup>2</sup>	Variables (d)	$\Delta R^2$
1979	F	0.19	-	-	D1	0.23	-	-
1980	F	0.21	ABEDS,SS	0.25	ABEDS	0.25	-	-
1981	F	0.23	ABEDS, GPS	0.30	ABEDS, GPS	0.52	-	-
1982	E	0.30	-	-	ABEDS	0.33	-	-
1983	E,P	0.39	-	-	ABEDS	0.27	-	-
1984	E	0.23	SS	0.15	ABEDS	0.17	-	-
1985	E	0.18	-	-	-	-	-	-
1986	E	0.25	SS	0.12	ABEDS	0.16	-	-
M.D.								
1979-86	E, P,SMR	0.57	ABEDS	0.10	ABEDS	0.52	SMR,P	0.13

**Notes:** M.D. = mean data.

socio-demographic factor accounting for 17% of the variation in the number of discharges per 10,000 population, whilst BEDS was the only important resource factor explaining 23% of the variation in discharges.

To ascertain the independent effect of the second set of factors when these socio-demographic and resource "best-predictors" were respectively controlled for, another series of stepwise regressions were performed. These took the following form. For each year the "best" socio-demographic factors for that year were forced into the regression model, and the resource factors then allowed to enter if they significantly improved (i.e.  $p < 0.05$ ) the level of explanation. The results, controlling for the socio-demographic factors, are shown in column b of Table 8.6. This lists the resource variables entered and the additional proportion of the variation they uniquely explained. For 1980, for example, both the supply of specialists (SS) and general practitioners (GPS) were significantly related to hospital discharge rates when area sex-ratios (F) and income levels (I), the best socio-demographic predictors in that year, were controlled for. F and I by themselves explained 39% of the variation in area discharge rates in 1980, but the model with F, I, SS and GPS as independent variables explained 68%. The increase in explanatory power represented the independent effect of the two resource variables. Thus, SS and GPS uniquely contributed to 29% of the variance accounted for by the regression.

Similar analyses were performed to determine the independent contribution of the socio-demographic factors when the medical resource factors were controlled for. These results are presented in

column d of Table 8.6. Take discharges in 1985 for example. The  $R^2$ -value of discharges regressed on BEDS and SS is 0.47. When P is entered into the model, 56% of the variation is accounted for. Thus, P contributed to an additional 9% of the variation explained in the 1985 discharge rates.

The results from this partitioning of variance illustrate that both measures of diabetes hospitalization investigated are sensitive to the supply of medical resources. When socio-demographic factors affecting utilization rates are controlled for, resource factors, in particular the availability of hospital beds and full-time specialists, contribute independently to an additional 10-20% of the explained variation in half of the regression models analysed.

When the resource factors were entered into the regression models first, only in three of the individual years studied, and only for discharge rates, did the socio-demographic factors add to the level of explanation. None of the "need" variables had significant partial correlations with patient days stay controlling for bed supply (D1 in 1979) in any of the eight years.

Collinearity between bed supply (BEDS or ABEDS) and area levels of education (E) is problematic since the inclusion of either as a main predictor variable tends to exclude or limit the explanation of the other factor(s). However, the fact that both are, on occasions, entered into the same model, illustrates an independent effect of each variable on hospital utilization rates.

This problem of collinearity or incomplete separation of the variance between the independent variables is further explored in Table 8.7.

The  $R^2$ -values in columns b and d of Table 8.6 are the effects uniquely attributable to the associated resource and socio-demographic factors, having controlled for the variables in columns a and c respectively. However, the proportions of variance explained by the best predictors from each set of factors (columns a and c) take no account of the possible linear or joint effect existing between these predictors and the new variables in columns b and d. In Table 8.6, in 1981 for example, the regression model of E and P explained 48% of the variance in the 1981 area discharge rates. Including bed supply (BEDS) increased the level of explanation by 13%. This represented the independent contribution of the supply of medical resources but E and P may be collinear with BEDS so their unique contribution, having separated any possible joint effect with BEDS is less than 48%.

Table 8.7 identifies the level of incomplete separation, that is, the collinearity between the independent variables in the regression models, identified in Table 8.6, that included variables from both the resource and socio-demographic sets of determinants. This partitioning of variance is the same as that used by Mood (1971) and Martini et al (1977).

Column h in Table 8.7 giving the total  $R^2$ -value of each regression model is a + b or c + d in Table 8.6. This total level of explanation is partitioned into three effects, that uniquely attributable

TABLE 8.7

**PARTITIONING OF VARIANCE BETWEEN AREA POPULATION  
CHARACTERISTICS AND THE AVAILABILITY OF MEDICAL CARE**

**(a) Discharges Per 10,000**

Models		R <sup>2</sup> Uniquely Sociodemographic (e)		R <sup>2</sup> Uniquely Resources (f)	Collinearity (g)	Total R <sup>2</sup> (h)
1980	F,I	0.63	SS,GPS	0.29	-.24	0.68
1981	E,P	0.04	BEDS	0.13	0.44	0.61
1982	E	0.17	BEDS	0.01	0.18	0.36
1985	E	0.01	BEDS,SS	0.25	0.23	0.48
1985	P	0.09	BEDS,SS	0.55	-.08	0.56
1986	E	0.11	BEDS	0.04	0.38	0.53
M.D. 1979-86	E	0.07	BEDS,SS	0.21	0.33	0.61

**(b) Patient Days Per 10,000**

Models		R <sup>2</sup> Uniquely Sociodemographic (e)		R <sup>2</sup> Uniquely Resources (f)	Collinearity (g)	Total R <sup>2</sup> (h)
1980	F	0.16	ABEDS,SS	0.25	0.05	0.46
1981	F	0.01	ABEDS,GPS	0.30	0.22	0.53
1984	E	0.38	SS	0.15	-.15	0.38
1986	E	0.36	SS	0.12	-.11	0.37
M.D. 1979-86	E,P,SMR	0.14	ABEDS	0.10	0.43	0.67
M.D. 1979-86	P,SMR	0.13	ABEDS	0.30	0.22	0.65

**Note:** M.D. = mean data.

to the socio-demographic factors (e), to the resource factors (f) and to collinearity (g). These effects are derived by calculating three regression models: (1) hospital use on socio-demographic factors; (2) hospital use on resource factors; and (3) hospital use on both sets of factors. The part uniquely explained by the socio-demographic sets of factors equals the proportion of variation explained by all factors (3) minus that explained by the resource factors (2). Similarly, the unique contribution of the resource variables is calculated by subtracting the  $R^2$ -value of (1) from that of (3). In Table 8.7, the proportion of variation explained either by socio-demographic or resource factors, in isolation, is the  $R^2$ -value uniquely attributable to them (e or f) plus the degree of collinearity (g). Thus, the unique effect of the socio-demographic factors is, for example,  $h - (f + g)$ . In the 1981 example, E and P were found to have independent effect of only 4%, and 44% of the total  $R^2$ -value of 48% was due to collinearity or effects inseparable between E, P and BEDS.

The outcome of this analysis similarly indicates the sensitivity of area rates of diabetes hospitalization to the provision of hospital beds. The negative collinearity that exists between the availability of the medical work-force and area attributes is indicative of suppressor effects (Martini et al, 1977). In 1984 and 1985 for example, the supply of hospital based specialists explained by itself none or little of the variation in patient days stay for diabetes. However, when the characteristics of the areas in which they practiced were controlled for (by E) then the availability of specialists was found to exert a positive influence on hospitalization rates.



The collinear term (column g in Table 8.7) tends to be large when bed supply and area levels of education are both independent variables. This indicates incomplete separation of the two effects. This situation is evident in the regression model with mean area annual rates of days stay per capita as the dependent variable, and with bed supply (ABEDS) as an independent variable having also controlled for the socio-demographic factors of education, ethnicity and health status. The independent effect of E, P, SMR was 0.14 and ABEDS 0.10, but the joint effect was 0.43.

In contrast, when resources were controlled for, that is, bed supply was forced into the model, the partial correlation of area levels of education (E) with patient days stay per capita (controlling for ABEDS) was not significant (partial  $r = -0.248$ , c.f. simple  $r = -0.620$ ). SMR and P maintained significance with partial correlation coefficients for SMR controlling for ABEDS of 0.384, and for P controlling for both ABEDS and SMR of 0.398. The independent effect of these two socio-demographic factors was 0.13 virtually the same as that for the preceding model which included E. The importance of ABEDS however increased, the collinear effect halved, and the total proportion of variance explained only dropped from 0.67 to 0.65.

Overall, very few of the area population attributes, apart from educational status, related directly or indirectly to the area rates of diabetes hospitalization. At this level of analysis, given the lack of independent explanatory power of the other socio-demographic factors, and its collinearity with hospital bed supply, the precise meaning of variable E is in doubt.

The spatial variation in educational status (such as measured in E) in New Zealand, and also the distribution of females to males which was also identified as an important predictor of use, largely reflect the processes of economic and urban development. Given the historical development of hospital services in New Zealand, and population changes in the last few decades, the smaller rural boards now have higher per capita supplies of hospital beds (Fraser, 1984; Hay, 1985; Joseph and Flynn, 1988). Rural areas typically have lower educational status and sex ratios biased towards males. As Chapter Seven illustrated, these areas tended to have the higher rates of diabetes hospitalization. In contrast, the larger urban hospital boards have fewer hospital beds effectively available for use by their populations, have higher proportions of people with tertiary education qualifications, and higher female to male ratios. These areas typically had lower rates of diabetes hospitalization.

While the logic behind variable E is sound (areas with higher proportions of their population acquiring higher educational qualifications would be expected to have lower admission rates since "better educated" individuals tend to seek health care earlier from general practice and to use preventive services more than members of the lower social classes) its role is questionable. E categorizes areas on the basis of the proportion of an area's population having gained tertiary education. This segregates the hospital boards in the same way as bed supply. E is so highly correlated with both bed supply variables that it may simply act as a locational surrogate of bed availability. Collinearity was evident over the entire study period, and

often the inter-correlation precluded the inclusion of both variables in the regression models.

This notion of surrogacy is reinforced when the spatial correlation of the other resource variables are considered and when the correlations with F are also taken into account. Take for example, the supply of general practitioners. Here the spatial distribution of medical resources is not a rural-urban dichotomy. General practitioners locate on the basis of a variety of professional and personal preferences (Barnett and Sheerin, 1978; Barnett, 1988). Doctor availability is therefore high in areas other than the main urban centres, for example in Nelson, Marlborough, Tauranga, Thames-Coromandel or Northland (Figure 8.3). The correlation between the variables GPS and E was only 0.34 for the mean annual data (Table 8.5), and doctor supply was not related to educational status in 5 of the 8 years.

Thus, there is good reason to believe a simple locational interaction occurs between the two best predictors of area rates of diabetes hospitalization. The social effect of education in health care behaviour may be valid at this level of analysis, and the unique contributions of this variable in explaining the variance in hospital use rates by areas cannot be ignored. However, the high degree of collinearity between bed supply and educational levels makes this variable suspect. If E is acting as an "unspecified" measure of rural-urban locale and a surrogate for hospital resource availability, which it appears to be doing to a large extent, then the importance of Roemer's concept of supply-induced-demand is strengthened. Its function as a socio-demographic control is weakened, and the

importance of hospital bed supply, which has already been identified as a key factor enhanced.

The important trends in this dataset, are perhaps best represented by the regression models of the area annual values meaned over the study period. Models of per capita discharge rates and patient days identified in Table 8.6 are presented in full in Table 8.8. At the beginning of the Chapter it was stated that excluding legitimate differences in area population characteristics may bias the effect of Roemer's Law upwards so although the meaning of E is somewhat questionable, the first model presented for discharges is perhaps the better indicator of the magnitude of Roemer's effect. Recall E is also correlated with other area population attributes, and therefore its inclusion partly controls for area socio-demographic differences. The regression coefficient for bed supply does remain significant at 0.16, a small reduction from that when BEDS is the only predictor of discharge rates. The importance of the hospital medical work-force as a factor independent of hospital bed supply and area is also apparent. An increase of two full-time specialists leads to an increase in three admission events.

The two patient days stay models have been discussed previously. The second model is perhaps the most appropriate of the two, since it recognizes the importance of socio-demographic factors by way of ethnicity and health status differences, but deletes educational status as a statistically non-significant factor. This latter action does, however, increase the effect of bed supply on patient days stay by 7 days from 23.1 days per 10,000 for an increase of 10

**TABLE 8.8**  
**REGRESSION MODELS OF AREA VARIATIONS IN**  
**HOSPITALIZATION FOR DIABETES**  
**(MEAN ANNUAL DATA 1979-1986)**

**(a) Discharges Per 10,000**

<b>Model 1</b>			<b>Model 2</b>		
<b>Independent Variables</b>	<b>Regression Coefficient</b>	<b>t-Value</b>	<b>Independent Variables</b>	<b>Regression Coefficient</b>	<b>t-Value</b>
E	-0.39	-2.07			
BEDS	0.16	3.15	BEDS	0.18	4.84
SS	1.48	2.33			
Constant	10.75		Constant	2.30	
R <sup>2</sup>	0.61		R <sup>2</sup>	0.48	
(F)	(11.96)		(F)	(23.46)	

**(b) Patient Days Per 10,000**

<b>Model 1</b>			<b>Model 2</b>		
<b>Independent Variables</b>	<b>Regression Coefficient</b>	<b>t-Value</b>	<b>Independent Variables</b>	<b>Regression Coefficient</b>	<b>t-Value</b>
E	-2.76	-1.12			
P	-1.91	-2.29	P	-1.72	-2.09
SMR	267.38	2.39	SMR	302.46	2.80
ABEDS	2.31	2.57	ABEDS	3.00	4.53
Constant	-100.26		Constant	-243.63	
R <sup>2</sup>	0.67		R <sup>2</sup>	0.65	
(F)	(11.28)		(F)	(14.46)	

beds per 10,000 in the first model to 20.0 days per 10,000 population in the second.

## 8.5 CONCLUSIONS

Marked variations occur between hospital board populations in their rates of hospital use for diabetes care. Hospital utilization is, however, a phenomenon which can be expected to vary considerably through chance effects alone (Diehr, 1984). Annual variations, and the levels of unexplained variability in the regression analyses, are commensurate with a high degree of randomness in area rates of diabetes hospitalization.

Hospital use, both in terms of per capita discharges and patient days stay was not, in general, well correlated with area population characteristics. Whilst educational status (E) was found to be the most important socio-demographic predictor of hospitalization rates, it is surmised that this factor is a reflection of the degree to which areas are urbanized, and may not be representative of health care behaviour per se.

Roemer's Law is evident in diabetes hospitalization. Bed supply is a key determinant, even when socio-demographic factors are controlled for, of both frequency of hospitalization as measured by the area discharge rates, and bed occupancy represented by patient days stay per capita. This later measure represented the cumulative effects of resource availability both on hospital admission and average length of hospital stay.

The importance of variables in explaining area variations in diabetes hospital use differs from year to year. Factors regarded conceptually as important explanatory variables, such as age, may be important at an individual level but are not powerful predictors at the aggregate level (Gornick, 1982). While hospital bed supply and educational status of the area populations consistently related to hospital use over time, other factors emerged as predictors of use in specific years. The potential importance of the supply of hospital-based specialists in promoting hospital use should not be overlooked, nor the overall influence of ethnic and health status differences.

Rates of diabetes hospitalization appear to have more to do with the availability of medical resources to area populations than to their socio-demographic characteristics. This finding is not dissimilar from that of Anderson (1973) who found in New Mexico that socio-economic factors had surprisingly little effect on levels of general hospital use while the supply of hospital beds was a major determinant. In terms of diabetes care, the only other study approaching this type of analysis is that by Connell et al (1984). They concluded that differences in admission rates for diabetes between areas of Washington State were not explained by differences in socio-demographic characteristics of admitted patients. Rather, small area variations reflected differences in admission practices evident by an observed inverse relationship between area admission rates and levels of medical urgency. Hospitals in high rate countries tended to admit more mildly ill patients. Areas in New Zealand with high bed supply have on average higher rates of diabetes hospitalization. Availability of beds may induce a similar admittance practice.

The direct relationship between general hospital bed availability and hospital utilization had been shown for all non-psychiatric admissions by Barnett et al (1980), and more recently, by Malcolm (1987) for mental illness and mental handicap beds. This study confirms the presence of Roemer's Law in New Zealand's hospital system, but for a "specific disease" entity.

Supply induced demand is of concern for economic reasons in the wastage or unnecessary use of expensive resources. However, this also reflects on the quality of diabetes care available to different population groups. People living in different parts of the country are at different risk to diabetes hospitalization. Whilst diabetes prevalence may vary, it is unlikely this would contribute to the total variation observed. Furthermore, socio-demographic factors important in diabetes aetiology were included in the analysis.

Area rates of hospitalization can be regarded as the outcome of local hospital admittance practices and individual health care behaviour. The next chapters therefore investigate diabetes hospitalization at the micro-level. It is to the local analysis that attention now turns.



## **CHAPTER NINE**

# **INSULIN-TREATED DIABETES MELLITUS IN CANTERBURY: A POPULATION DATABASE**

### **9.1 INTRODUCTION**

Area variations in hospitalization rates for diabetes have been observed at the hospital board level. As indicated in the previous chapter, variations in hospital use by the 27 hospital board populations are, in general, poorly explained by differences in their demographic characteristics. Hospitalization for diabetes does, however, appear to be influenced by the availability of health care resources. The hospital use patterns described and analysed in Chapters Seven and Eight, are most likely the net outcome of differences inherent in individual patient characteristics and local health care practices. These two factors are not necessarily well expressed at the aggregate level.

Connell and colleagues (1984), for example, concluded in their study of diabetes hospitalization, that small area variations in Washington State in the use of hospitals for diabetes care related to differences in admittance practices and medical management of diabetic patients, and not socio-demographic factors. Greater proportions of patients with mild diabetic illness were admitted to hospital in counties where rates of diabetes hospitalization were high.

Physicians in these "high use" areas tended to be less vigorous in their diagnosis and treatment of diabetes.

Hospitalization of persons with diabetes raises two important social concerns, namely the persistence of health inequalities and inequities in access to appropriate forms of health care. Diabetes hospitalization may involve one of two situations. First, the cause of admission is of some medical urgency and/or seriousness which warrants hospitalization of the patient. The patient suffers either from an acute complication of diabetes which compromises his/her health in the short term, or from a chronic complication which may have lead to a major deterioration in health over a number of years. Second, the medical necessity for hospitalization is in doubt. The problem precipitating hospital admission could have been dealt with on an ambulatory basis in primary care or through specialist diabetes services. The patient is admitted for reasons of medical/social convenience or because other ambulatory services were inaccessible when need for care arose.

Inappropriate use of resources and unnecessary hospitalization are in the public eye because of economic issues. The two situations above are of fundamental importance, moreover, because they are inextricably linked to issues of social inequity in people's long term health outcomes and their access to quality care. With this in mind, the aim of this and next two chapters is to explore possible provider and organizational influences on diabetes hospitalization at the local level.

Chapter Eight examined the relevance of Roemer's Law in explaining the small area variations in hospital use in terms of the current availability of health care resources and area population characteristics. Chapters Nine to Eleven investigate the second aim of the thesis which is to identify the influence exerted by the health care system via the organization of diabetes care, on local patterns of diabetes hospitalization. The most effective way of undertaking such an analysis is by using an identifiable diabetic population and adopting the population approach to the measurement of diabetes hospitalization discussed in Section 7.2 of Chapter Seven.

The Canterbury Hospital Board area was chosen as the study area at the local level even though it had relatively low per capita rates of diabetes hospitalization at the regional level. This choice is justified for two main reasons. First, an area had to be chosen which had a population size large enough to have a diabetic community sufficient in number to facilitate the microscale analyses. Given the prevalence of diabetes in the general population, this restricted the selection of a study area to the large urban based hospital boards. Canterbury is a well defined geographic unit and the characteristics of its population are appropriate to this study. In 1986, it had a usually resident population of 348,600 persons, 12% of whom were aged 65 or more years. Thus, the diabetic population was expected to be sizeable, yet manageable for research purposes. If results were to be reliable and informative, then an area population had to be chosen from whom a reasonable number of hospital admissions could be expected.

Second, and equally important, since the impact of the organization of diabetes care was to be examined, an area had to be chosen on the basis of the local health services system and the type of care available. Canterbury has a well developed diabetes health care organization. An integral component of local service provision is specialist diabetes educational services. In the late 1970s, educational facilities were superimposed on the existing service hierarchy of general practitioner care, diabetes outpatient clinical services, and hospital inpatient services. Organizational links and service interactions between these four components of diabetes care are well established in the 1980s. Referral practices and provider behaviour are therefore expected to be entrenched in the structure of the local health care system.

If patterns of health services utilization are to be properly understood, and health care most effectively provided, then target populations need to be appropriately identified. A fundamental problem in health planning and evaluative research is the absence of essential epidemiological data on study populations. The research at the local level therefore adopts the population approach to diabetes hospitalization by examining *hospital use by diabetic persons* rather than *hospitalization for diabetes*. Given the aims of the two preceding chapters, data limitations, and the level of analysis, the disease-oriented approach using the general population as the population denominator was an acceptable, and in fact the only practical methodology to use in the regional analysis. However, effective research on the organization and use of diabetes services at the local level demands the specification of a diabetic population

from which both user and non-user groups of diabetes services can be identified.

The investigation of organizational determinants of hospitalization cannot be pursued without establishing a target diabetic population and epidemiological database. This chapter therefore aims to identify the prevalence of Insulin-Treated Diabetes Mellitus (ITDM) in the Canterbury area and to profile the socio-epidemiological characteristics of the ITDM population. These objectives are facilitated through the development of the population based Canterbury Register of Insulin-Treated Diabetic Persons. The development and application of this database is the focus of the succeeding methodological section. For reasons identified shortly, it is only feasible to study ITDM and not the whole diabetic population.

Section 9.3 presents results on the epidemiology of ITDM in Canterbury. The tasks of measuring the prevalence of this disorder in the general population and identifying the characteristics of those people affected are major undertakings and of enormous value in themselves. The Canterbury Register was, however, developed by the author as a methodological tool to be used in identifying and measuring patterns of health services utilization by the ITDM population. While this Register is a very powerful epidemiological database, only those results pertinent to the objectives of this thesis will be presented here. Aspects of diabetes epidemiology which are of health importance but which add little to the argument of this thesis, will not therefore be discussed.

The aim of Section 9.3 is to provide essential demographic, social, residential and diabetes data on the study population. Chapter Ten then identifies patterns of hospitalization of persons with ITDM and Chapter Eleven examines the influence of organizational factors in explaining these patterns.

## **9.2 DEVELOPMENT OF THE CANTERBURY REGISTER OF INSULIN-TREATED DIABETIC PERSONS**

The Canterbury Diabetes Register forms the primary population database of the local analyses. Population-based registers for chronic disorders are invaluable for better understanding the epidemiology of a particular disorder and use of health services by those affected. Insulin-Dependent Diabetes Mellitus (IDDM), unlike Non-Insulin Dependent Diabetes (NIDDM) (see Chapter Five for definitions) is well suited to systematized data collection and register development. This section discusses the rationale for using insulin-treated diabetes mellitus (ITDM) as a population base for this analysis and the methods used in the development of the Register.

The lack of comprehensive epidemiological data on study populations is one of the most restrictive and persisting problems in health services research. Demographic, socio-economic, geographic and health-related information on all persons affected by a health disorder in the community is often simply not available. Existing methods of using population samples, "before and after treatment" studies, and/or selective service-user populations are inappropriate to the requirements of this research. While these methods have certainly contributed to the understanding of resource utilization,

their application is limited since the sample of patients included in a study may not be representative of the total affected population, the characteristics and behaviour of "drop-outs" and non-users cannot normally be identified, and individual results and trial conditions cannot always be extrapolated to populations and applied in the wider community. These difficulties are largely overcome by the development of population-based patient registers.

A substantial part of the time devoted to the research in this thesis was involved in the development of the Canterbury Register database. The requirement for a population database coincided with increasing international interest in the development of diabetes registers. The first international workshop on diabetes registers was held in Philadelphia in late 1983 and was attended by a small number of participants from eight countries only (Hamman and Berlin, 1985; La Porte et al, 1985). At this time fewer than ten registers, all centred on diabetes in youth, were in existence. This group, now known as DERI (Diabetes Epidemiology Research International) called for the standardization of IDDM registers and encouraged the establishment of a world-wide network of registers, primarily to facilitate the identification of global patterns in IDDM epidemiology.

Five years later, the contribution of population-based registers to diabetes research is well recognized. The establishment of the Canterbury ITDM Register by the author, has enabled New Zealand not only to participate in this international network but also to act as a major contributor in the development of diabetes registers. In February 1988, DERI identified 20 IDDM registers across the world

as having information suitable for a standardized epidemiological report on diabetes in childhood and adolescence.

In practical terms, this research was restricted to identifying the insulin-treated diabetic population. Age of onset of NIDDM is usually over 30 years of age. Since B-cell destruction is incomplete in this condition, it is usually managed by diet, weight control and exercise, supplemented where necessary by tablet medication. There is no way of identifying all persons within the community who have NIDDM, other than by a complete household survey with rigid biochemical and clinical inclusion criteria. Undertaking such a task is impractical in almost all situations and has not been feasible outside a few select geographic areas in the world.

In contrast, IDDM is well suited to investigation through patient registration, although by no means free of problems. For IDDM:

- (1) There is a common set of symptoms which, at presentation, makes the diagnosis relatively easy;
- (2) It is a severe disorder that necessitates patient contact with health services for the duration of life;
- (3) It does not have a high rate of mortality at the onset of the disorder, although it affects health with increased duration; and
- (4) Unlike many other chronic diseases, it has a readily identifiable marker, i.e. the use of insulin.

Ascertainment of all individuals within a population who are insulin-treated identifies all IDDM individuals. The Canterbury



Register, developed concurrently with that of Tasmania (King et al, 1986), has been developed for the entire insulin-treated diabetic population of the study area. These registers will include some "NIDDM" individuals who for a variety of reasons are treated with insulin. However, the true nature of diabetes pathogenesis in these individuals is unclear and it is virtually impossible clinically and biochemically to categorize such persons. A simple method of identifying such cases is by examining the time delay between commencement of insulin therapy and date of diagnosis.

International standardized criteria for IDDM registers are:

- (1) Standard definition of cases. Registers must have unambiguous case definition. The WHO Expert Committee on Diabetes (1985) has documented standard definitions for the diagnosis of diabetes which are internationally accepted and applied to identify cases for inclusion in diabetes registers.
- (2) Population-based data collection. Registers must include all cases, i.e. be population based. A variety of methods can be used to ascertain register populations. Data collection methods depend upon access to patient information and the health care system in which researchers are working. The optimal method of identifying the ITDM population is by following the trail of insulin, through insulin prescriptions. This option was not available here because the New Zealand Department of

Health will not, at present, grant access to prescription data.

- (3) Case ascertainment. It is critical to have at least one independent secondary data source which can be used to validate register data derived from the primary information sources. The degree of case ascertainment of the register can be gauged by cross-referencing cases identified in the secondary data source with the primary database and determining percentage of cases matched versus unmatched.
- (4) Common set of core variables. If registers are to be used for international collaboration then a common set of variables needs to be included on each register, e.g. date of birth, sex, race, date of diagnosis of diabetes. Other parameters identified on the register depend upon individual research requirements.

These criteria were applied in the development of the Canterbury register.

Register development was feasible in Canterbury because of the character of the area and nature of the local health system. The area over which the Canterbury Hospital Board has authority is geographically and administratively well defined. The area's population is relatively stable in composition and size, and highly urbanized; in 1986 85% of the region's residents lived within the Christchurch urban area.

Local health services are spatially concentrated in Christchurch City. Diabetic patients receive care from general practitioners, specialist ambulatory diabetes services, and hospital inpatient care. The latter two are provided predominantly by the local hospital board with a small input in more recent years from private hospitals and specialist diabetes physicians working part-time in private practice. The two specialist ambulatory services available are the Diabetes Outpatient Clinic providing annual medical review and specialist intervention, and the affiliated Diabetes Centre functioning as a patient education and resource centre.

The Register was officially established for the prevalence date of 1 January 1984. This essentially equates to a census of insulin-treated diabetic persons in the Canterbury Hospital Board areas as at 1 January 1984. Individuals were entered onto the Register if they met three basic criteria:

- (1) They had been diagnosed as having diabetes by a medical practitioner;
- (2) They were using insulin as a long-term treatment modality; and
- (3) They were usually resident in the Canterbury Hospital Board area.

All persons, regardless of age, whose usual treatment modality involved administration of exogenous insulin were included in the database. This makes the Canterbury Register one of the most powerful diabetes registers currently operative. Most registers have

limited inclusion to persons under 20 years of age, or whose age at onset of diabetes was under 20 years. As the results presented here will show, this eliminates most of the population (with autoimmune insulin-dependent diabetes mellitus). Regardless of etiopathogenesis, if a register is to be applied to health care evaluation, it must include all insulin-treated subjects irrespective of age.

Data on prevalent cases were collected in the three main variable categories:

- (1) Socio-demographics - patient name, national hospital identification number, residential address, date of birth, sex, marital status and occupation;
- (2) Diabetes factors - year of diagnosis, year in which use of insulin commenced; and
- (3) Health services utilization - general practitioner, date first attended Diabetes Centre and referral agent, date first attended Outpatient Clinic.

Additional variables included: age at onset and duration of diabetes which were derived from variable transformations; and various coding variables for data manipulation and analysis. A variable indicating racial background was not included in the patient demographics because there are only small numbers of non-Caucasians in this community, and furthermore the attack rate for

IDDM is at least 50% lower in these groups (Elliot and Pilcher, 1985).

All data were stored and analysed on a micro-computer. The Register was constructed using a database management system. This facilitated ease of entry and editing of register cases, data manipulation and display, the creation of summary reports, and the undertaking of some data analyses. For in-depth statistical analysis, the register database was transformed into a numerical data file.

The primary data source was a community-based survey of insulin-using diabetic individuals. This survey was organized through the Department of Medicine of the Christchurch School of Medicine at the Princess Margaret Hospital, with the support of Novo Industries, a manufacturer of insulins used widely in Australasia. A simple one-page questionnaire was designed to elicit information on patient demographics, diabetes treatment regimes and use of health services (Appendix E.1). The data sheet was distributed by the Southern Divisional Representative of Novo Industries to all retail pharmacies in Canterbury in late 1983.

In New Zealand, patients obtain their insulin supplies from local retail pharmacies, not from hospitals. When individuals had their insulin prescriptions filled, they were asked by the pharmacist (on my behalf) to complete the data sheet. In many instances, the chemist was also able to give a complete record of all regular insulin-users. In the infrequent situation where the individual obtaining insulin declined participation, the pharmacist was requested only to

indicate the existence of an ITDM person for the purposes of enumeration and no personal data was collected.

The completed survey sheets were collected by the Novo Representative, or the pharmacies forwarded them directly to the Department of Medicine. The survey operated over a four-month period and in some cases longer, depending on the date of collection. Since prescriptions are only legally valid for three months, this length of time provided for at least one-month overlap thus insuring complete pick-up of patients.

A high respondent rate was anticipated as over 95% of the local pharmacies had expressed support of the survey. In addition, a similar technique had been trialled previously in 1981. However, participation was not as high as expected as revealed by the secondary data source. Data from the community survey was validated using the one-year prospective audit of all admissions to Christchurch hospitals by diabetic persons in 1983 (Brown et al, 1985). In total, 900 persons had been entered onto the Register from the community survey. By cross-referencing insulin-treated cases from the hospital inpatient database, only 75% of the insulin-treated diabetic individuals living in Canterbury and admitted to hospital in 1983 could be identified on the primary register. The community survey, thus, appeared to have under-reported prevalence by 25%.

Additional methods were therefore required to achieve a detection rate of ITDM persons close to 100%. Hospital patient casenotes, hospital admission and discharge data, Diabetes Outpatient

Clinic records, and Diabetes Centre records were all rigorously scrutinized. The data sheet was reproduced in the local lay Diabetes Society magazine, and members requested to fill it in if they had not otherwise done so through the community survey.

A further community survey was also instigated again using pharmacies as the point of access to patients. This survey spanned nearly 12 months. Patients receiving insulin were invited to participate in the register development by completing the questionnaire (essentially unchanged from 1983) and returning it via "Freepost". The aim of this second survey was twofold:

- (1) To give an update of the ITDM population to 1 January 1987; and
- (2) To help to retrospectively complete the 1984 register database.

Finally, local medical personnel working with diabetic patients were approached. General practitioners were contacted only to verify information or to collect data not otherwise obtainable. (It is interesting to note that general practitioners are basically unaware of their diabetic case-load, and are therefore unable to supply accurate data).

For the register to be successful, complete case ascertainment and accuracy of information relating to each registrant was essential. All of the secondary data sources yielded additional cases, although less than 5% of all detected cases were from general practitioners or the lay Diabetes Society.

The retrieval and scrutiny of data was time-consuming and frustrating. The community survey data was often incomplete - patients had difficulty in recalling details, they frequently did not answer all questions, or answered in a non-specific manner. Patient records held as hospital, outpatient clinic and Diabetes Centre casenotes usually required individual scrutiny in order to complete even the most basic facts for a register, date of birth or date of diagnosis for example. Comparative patient files had inconsistencies and inaccuracies, data was often outdated or simply missing. There was a constant need to re-check the data. Furthermore, much of the information had to be gleaned from the casenotes as basic patient details were not routinely documented. This was particularly the case for marital status and occupation which had not been included on the community survey data sheets. Data on these two variables were for a significant number of registrants elicited from local body electoral rolls.

The Register also initially over-enumerated the ITDM population by including individuals (approximate  $n = 40$ ) who had in fact died prior to 1 January 1984. Casenotes were still active in some cases for patients who had been dead for over two years. Similarly, several individuals had been entered onto the register who had shifted out of the region prior to the prevalence date (approximate  $n = 20$ ). An additional sporadic problem was the double counting of young adult females who had married but were identified under both maiden and married names.



The establishment of the Register was thus a time-consuming process spanning nearly four years. Case ascertainment is now believed to be close to 100%. Since the initial stages of development, only one or two sporadic cases have been identified as having been missed off the Register.

This research has been ethically approved by the Ethical Committee of the Canterbury Hospital Board and Christchurch School of Medicine. Patient details are kept strictly confidential. There is no interest whatsoever in individuals. Patient names and addresses were identified simply because this was the only way of accessing the data. Many of the methods used in establishing the Register were laborious and cumbersome, but the techniques were in keeping with the original ethical conditions of establishing the Register as an epidemiological and health services research database, but not as a means of directly accessing individual patients. Copies of ethical agreements associated with this research are given in Appendix E.2.

### **9.3 INSULIN-TREATED DIABETES MELLITUS: EPIDEMIOLOGY ACROSS ALL AGES**

This section reports the prevalence of ITDM in Canterbury, and profiles the socio-epidemiologic characteristics of the ITDM population. Essential demographic, social, residential, and diabetes characteristics of the population are identified.

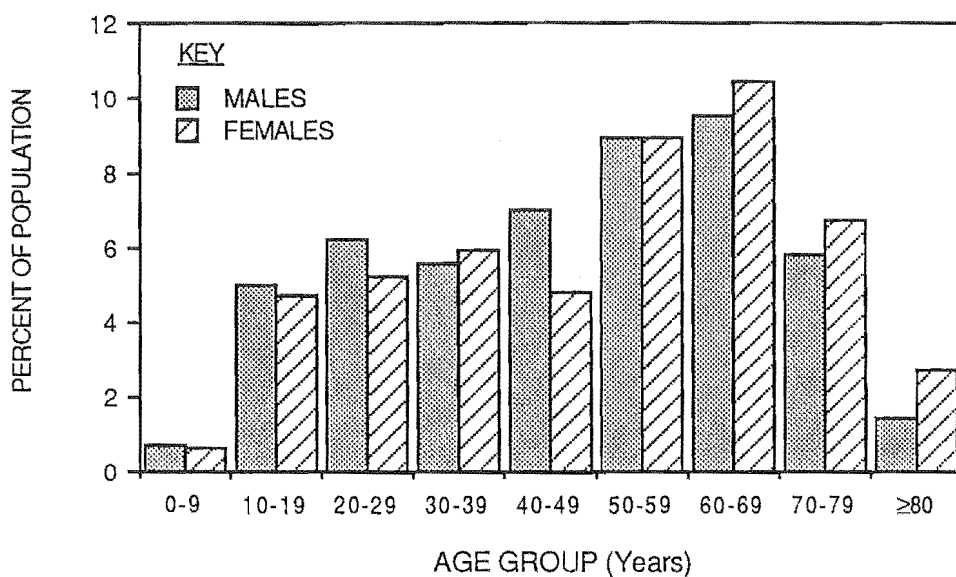
### 9.3.1 Socio-Demographic Characteristics - Who Has ITDM?

At the prevalence date of 1 January 1984, there were a total of 1148 insulin-treated diabetic persons living in the Canterbury Hospital Board area. Half of the population were male and half female. The age-sex structure of the population is given in Figure 9.1 and cumulative age distribution in Figure 9.2. Age ranged from 5 to 90 years with mean of 47.6 in males and 2 to 93 years with mean of 49.9 in females. While there were similar numbers of males and females in childhood and adolescence, there was a male predominance in middle-age and a clear bias towards females in the older age groups ( $\chi^2$  n.s. for 10 year age groups).

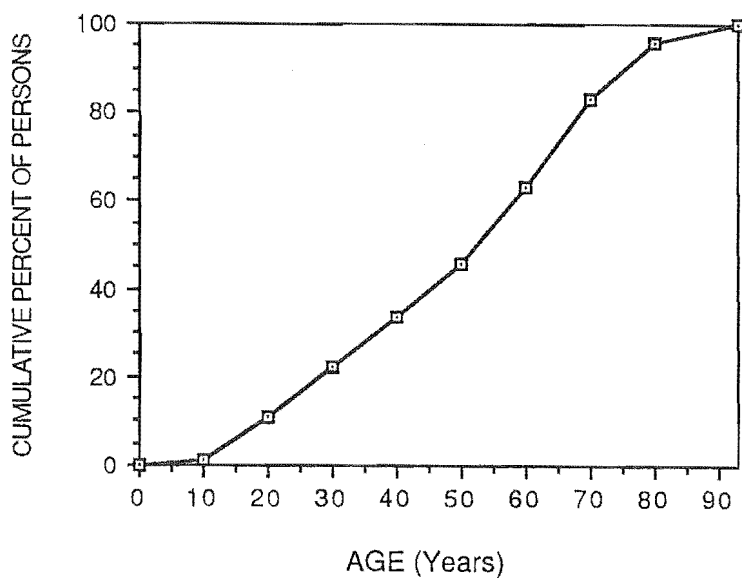
The population is elderly with a median age of 52 years. Only 11.1% of individuals are under 20 years of age. In contrast, over 25% are aged 65 years or above, that is for every two children or adolescents with ITDM, there are five elderly individuals.

Overall, the prevalence of ITDM in Canterbury's population at large was enumerated at 3.29 persons per 1000 population. Prevalence of this disorder was slightly higher in males than females, especially in middle and old age (Table 9.1, Figure 9.3). Prevalence increased with age, illustrating that ITDM is both absolutely and relatively less frequent in children compared to adults.

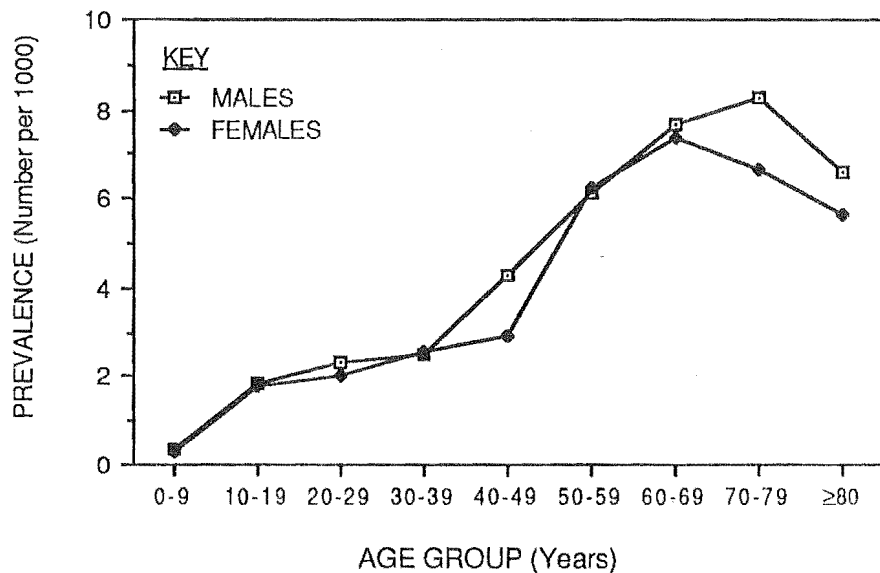
Characteristics of the population in terms of marital status and social class not unexpectedly reflect the age distribution. As Figure 9.4 shows, the majority of persons were married (or lived in de facto relationships). A large proportion of the females (23.8% of those



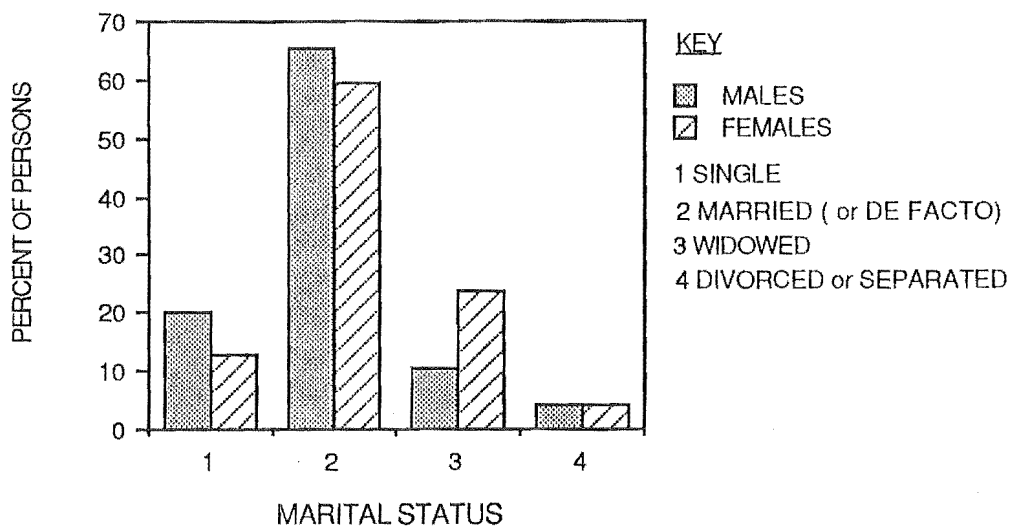
**Figure 9.1:** Age Sex Structure of Canterbury ITDM Population.



**Figure 9.2:** Cumulative Age Distribution of the Register Population.



**Figure 9.3:** Prevalence of ITDM.



**Figure 9.4:** Marital Status of the ITDM Population Aged 16 Years and Over.

TABLE 9.1

**PREVALENCE OF INSULIN-TREATED DIABETES MELLITUS  
IN CANTERBURY AS AT 1 JANUARY 1984**

**(a) Males**

<b>Age Group (Years)</b>	<b>Population<sup>1</sup></b>	<b>No. of Diabetic Persons<sup>2</sup></b>	<b>Prevalence (Per 1000)</b>
0-9	23697	8	0.34
10-19	31374	57	1.82
20-29	30165	70	2.32
30-39	25683	64	2.49
40-49	18957	81	4.27
50-59	16635	102	6.13
60-69	14187	109	7.68
70-79	8109	67	8.26
80+	2430	16	6.6
<b>Total</b>	<b>171228</b>	<b>574</b>	<b>3.35</b>

**(b) Females**

<b>Age Group (Years)</b>	<b>Population<sup>1</sup></b>	<b>No. of Diabetic Persons<sup>2</sup></b>	<b>Prevalence (Per 1000)</b>
0-9	22926	7	0.31
10-19	29874	54	1.81
20-29	29301	59	2.01
30-39	26274	67	2.55
40-49	19092	56	2.93
50-59	16482	103	6.25
60-69	16293	120	7.37
70-79	11601	77	6.64
80+	5496	31	5.64
<b>Total</b>	<b>177333</b>	<b>574</b>	<b>3.24</b>

1. 1986 Census Population of Canterbury Hospital Board Area, differences in totals and column totals are due to rounding errors.
2. The 4 male and 6 females with missing ages were assigned to age groups on the basis of the frequency of registrants with age  $\geq 40$  years.

aged  $\geq 16$  years and in whom marital status was specified) were widowed, compared to 10% of males. The distribution of individuals across marital status, and the differences between the sexes, are reflective of Canterbury's population at large, with the exception of an over-representation of widows and widowers in the ITDM population.

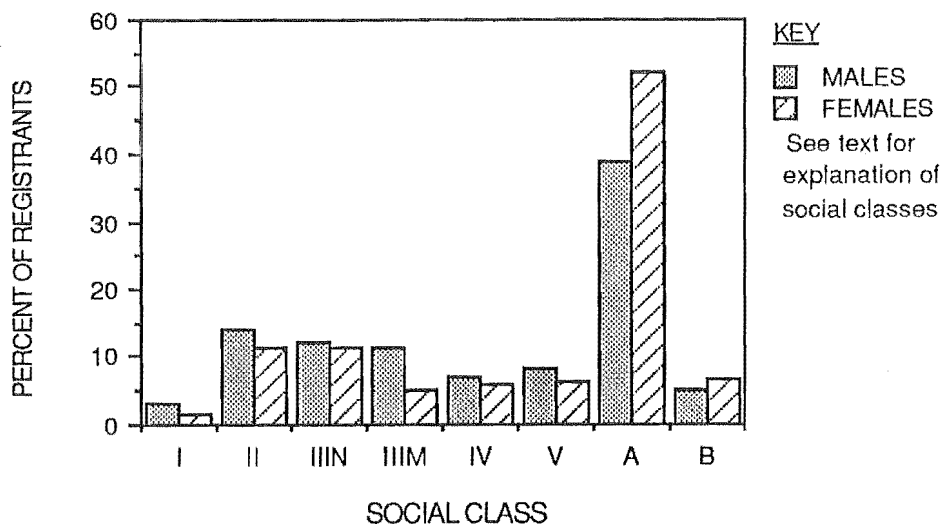
Derivation of individual social class, an important indicator of morbidity and health care behaviour, proved to be difficult. Social class characteristics of the Register population were investigated using the British Registrar-General's classification of social class (British Office of Population Censuses and Surveys, 1970) which is used extensively in morbidity and mortality studies (Pearce et al, 1983). This categorizes individuals on the basis of occupation into five social classes:

- (1) I. Professional and higher managerial occupations, e.g. doctors, lawyers, scientists;
- (2) II. Intermediate occupations, e.g. teachers, nurses, farmers, most managers;
- (3) IIIN. Skilled non-manual occupations, e.g. retail and clerical workers;
- (4) IIIM. Skilled manual occupations, e.g. most tradespersons, carpenters, welders, drivers, etc;
- (5) IV. Partly skilled occupations, e.g. factory process workers, farm labourers; and
- (6) V. Unskilled occupations, e.g. cleaners or general labourers.

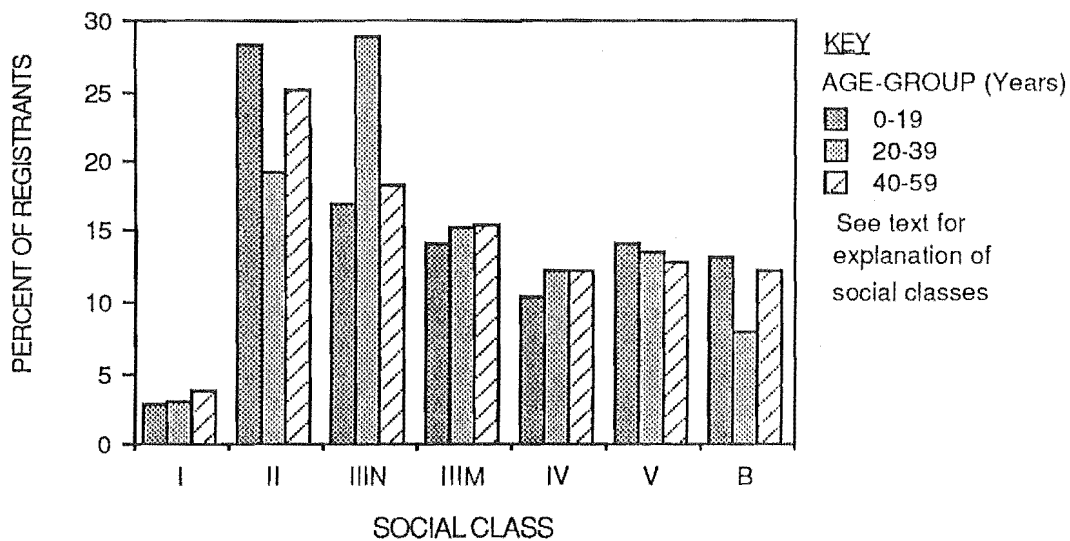
Typical of health statistics, occupational data on individuals was poorly reported in patient casenotes (although more readily available than any other socio-economic indicator, e.g. level of education or income). Additionally, the majority of females are identified in hospital records as housewives or home domestics. Children are similarly recorded as school girl/boy/student. These say little about the individual's social circumstances. The approach taken was, therefore, to identify where possible, the highest prestige occupation in a household and this was then assigned to each individual. This measure of social class therefore reflects to some extent the socio-economic status of the diabetic person's family.

The basic demographic characteristics of the ITDM population also requires the addition of two classes "A" and "B". Class A simply represents superannuitants. Past occupations were known for some individuals but most elderly people were identified solely as retired, and thus no inferences could be made on their social circumstances other than those pertaining in general to retirement. Class B is a composite class indicating for example, that the individual is unemployed, a social welfare or illness beneficiary, on a widow's pension, or is a tertiary student. X

In total, a social class ranking was assigned to 91% of the 1148 registrants. The distribution of social class by sex is shown in Figure 9.5, and by three broad age bands (excluding retired individuals) in Figure 9.6. Class "A" retirement dominates the social class strata with over 50% of females being assigned to this category, and 39% of the males. Insulin-treated diabetes does, however, span all social X



**Figure 9.5:** Distribution of Social Class by Sex.



**Figure 9.6:** Social Class Distribution by Age of ITDM Persons.



classes with 25% of individuals coming from skilled non-manual or intermediate occupational backgrounds.

The percentages of individuals in classes IIIM to B are similar with little variation being observed between the three age bands (Figure 9.6). This distribution by social class may reflect, in part, the very small proportion of ethnic minorities, and in particular the Polynesian population, in this diabetic community. It is not surprising that the distributions for children and adolescents, and the 40-59 year olds are similar, given that the parents of the former will in many cases be in this age group or approaching it. The social class differences evidenced in classes II, IIIN and B, between those in younger working life and the two other age groups may be accounted for by life cycle factors of career development, family stability and job security.

Whether there is any increased risk to ITDM for different social classes is difficult to ascertain from this data. As stated in Chapter Five, there may be an association between social class and non-insulin dependent diabetes through lifestyle factors, especially diet, but no substantive work has been undertaken on the prevalence of ITDM by social class. A very crude comparison of social class in New Zealand males aged 15 to 64 years (Pearce et al, 1983) and ITDM males aged 15-64 years is given in Table 9.2. With the caveats that some changes may have occurred in relative membership to the different social classes since 1976, and there may be ethnic differences, that Canterbury's employment structure may differ from the national average, it would seem more diabetic males belong to social classes IIIN and V, and fewer have skilled manual occupations. Pearce et al

**TABLE 9.2**  
**SOCIAL CLASS DISTRIBUTION OF EMPLOYED MALES AGED**  
**15-64 YEARS FOR NEW ZEALAND (1976) AND INSULIN-TREATED**  
**DIABETIC MALES IN CANTERBURY**

<b>Social Class</b>	<b>New Zealand Males</b>	<b>ITDM Males</b>
I	5.3	5.5
II	24.6	24.4
IIIN	11.8	22.9
IIIM	37.4	19.6
IV	15.3	13.1
V	5.8	14.5
Total	100%	100%

(1983) states that membership of a lower social class could in some cases be a consequence, rather than a cause, of chronic disease. Diabetic males may relocate themselves within the occupational hierarchy, either shifting upwards from class IIIM to non-manual positions, or alternatively opt for unskilled work where they might perceive the impact of the diabetes on the employment is minimized.

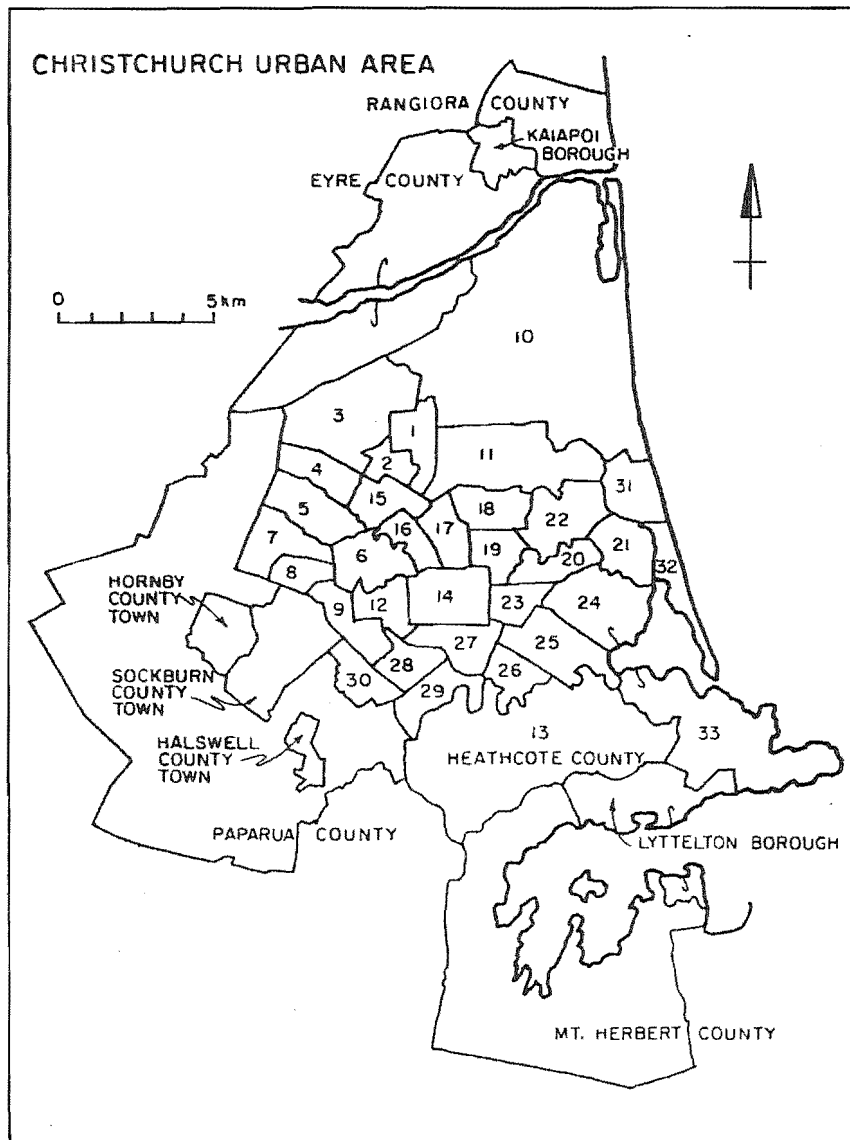
### **9.3.2 Spatial Distributions - Where Do These People Live?**

Characteristic of Canterbury's core-periphery regional structure is the residential location of 89% of the ITDM population within the statistical boundaries of the Christchurch urban area. Of the 124 individuals living in rural Canterbury (Figure 9.7), half live in either the district or borough of Rangiora ( $n = 40$ ), or in Ellesmere County ( $n = 25$ ). Both areas are in the urban shadow with many residents commuting to work and shop in the city. The 124 individuals attend general practitioners located in rural towns, but travel into Christchurch for higher order medical services.

Contiguous urban census subdivisions were used to examine the spatial distribution of ITDM persons in the urban environment (Figure 9.8) (subdivisions were amalgamated on the basis of like socio-demographic characteristics to form the area units used in the analysis). Appendix E.3 lists the number of ITDM persons in each area at 1 January 1984 and the area populations at the 1986 census.

Insulin-treated diabetic individuals reside throughout parts of the city (Figure 9.9). At least ten persons with ITDM live in each area, with the exception of three of the four county parts. Demand is

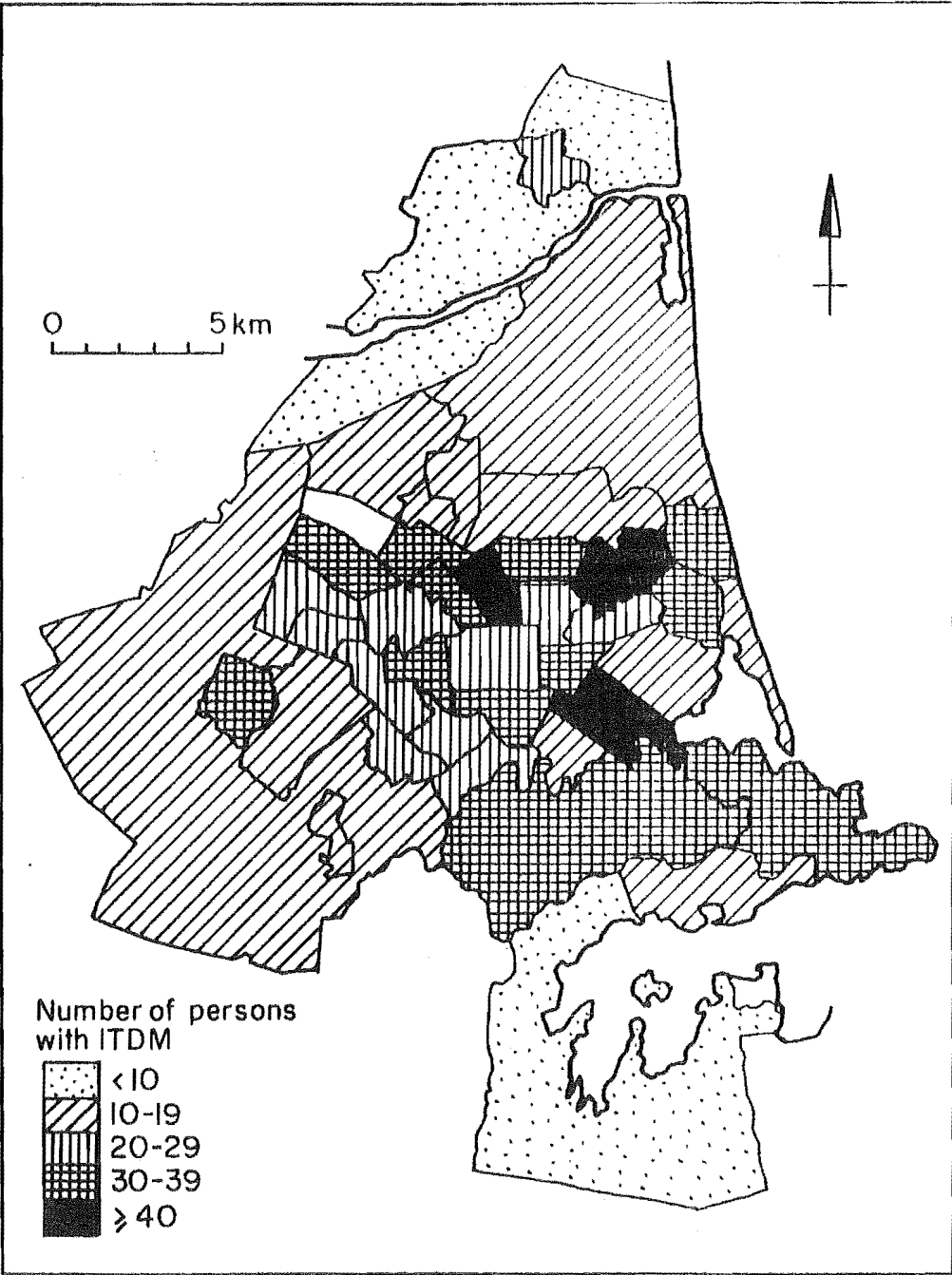




#### City Subdivisions:

- |    |  |    |   |
|----|--|----|---|
| 1  | Redwood, Styx Mill                           | 15 | Papanui, Aorangi  |
| 2  | Casebrook, Northcote                         | 16 | Strowan, Merivale   |
| 3  | Sawyers Arms, Kaimahi                        | 17 | Malvern, St. Albans   |
| 4  | Harewood, Bishopdale                         | 18 | Mairehau, Shirley   |
| 5  | Russley, Burnside,<br>Wairarapa, Jellie Park | 19 | Edgware, Richmond   |
| 6  | Bryndwr, Holmwood,<br>Fendalton, Deans Bush  | 20 | Chisnall, Avonside  |
| 7  | Merrin, Westburn,<br>Masham                  | 21 | Aranui, Bexley  |
| 8  | Avonhead, Ilam                               | 22 | Burwood, Wainoni  |
| 9  | Upper Riccarton, Wharenui,<br>Middleton      | 23 | Linwood   |
| 10 | Belfast, Styx                                | 24 | East Linwood, Bromley   |
| 11 | Marshlands                                   | 25 | Woolston, Ensors  |
| 12 | Riccarton Borough                            | 26 | Opawa, St. Martins  |
| 13 | Cashmere, Hillsborough,<br>Valley            | 27 | Waltham, Sydenham,<br>Addington                               |
| 14 | City   | 28 | Barrington North, Spreydon                                    |
|    |  | 29 | Barrington South,<br>Hoon Hay South, Somerfield,<br>Beckenham |
|    |  | 30 | Hoon Hay, Hillmorton  |
|    |  | 31 | North Beach, Rawhiti  |
|    |  | 32 | Brighton  |
|    |  | 33 | Mt. Pleasant, Clifton,<br>Sumner                              |

**Figure 9.8:** Subdivisions in Christchurch Urban Area.

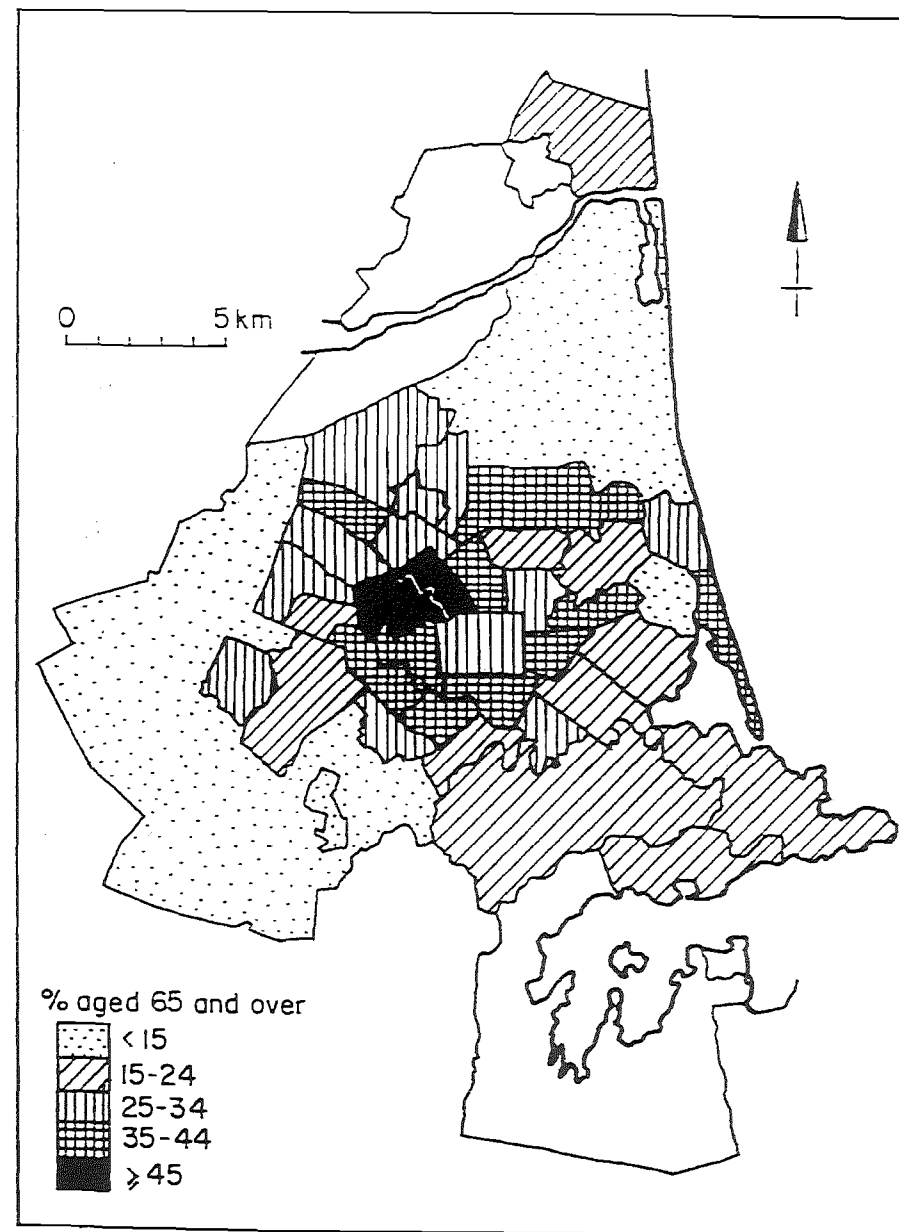
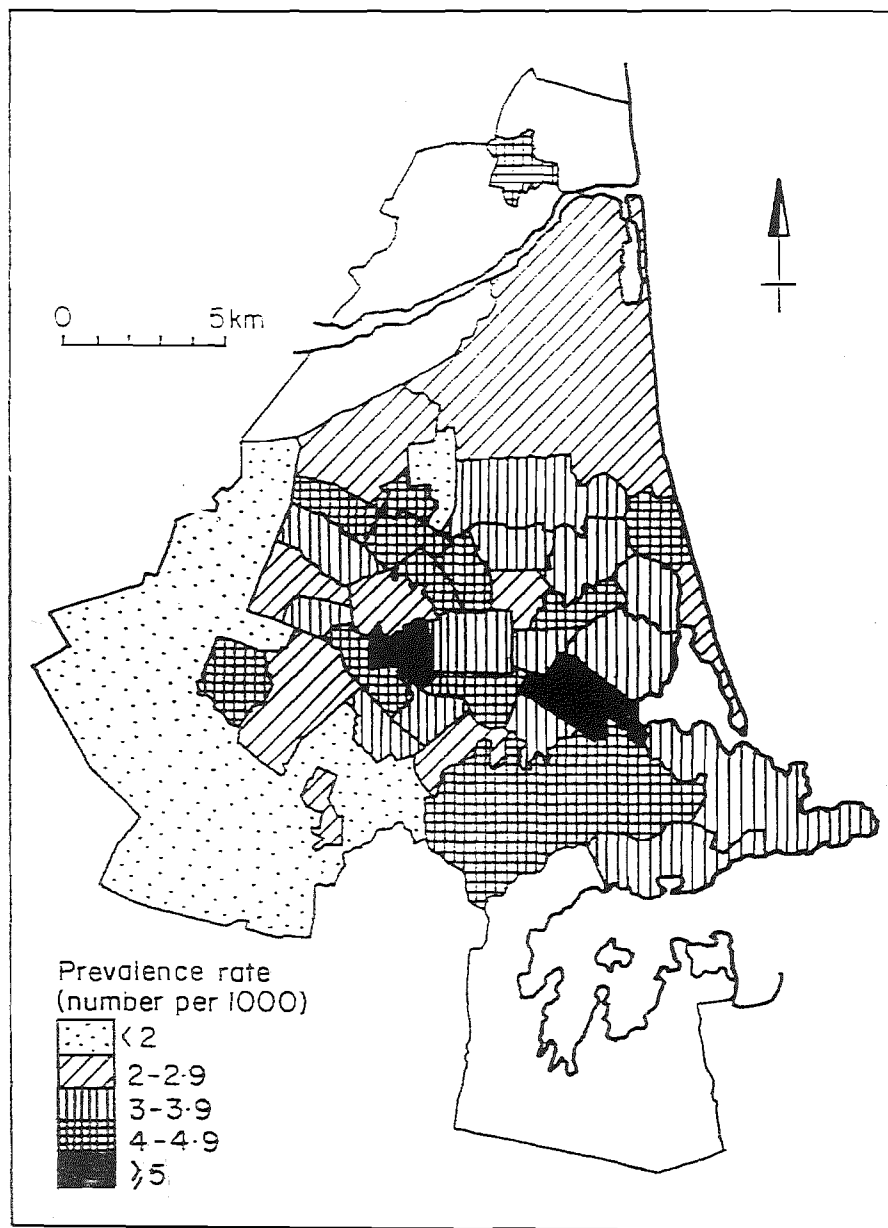


**Figure 9.9:** Residential Location of the ITDM Population in Christchurch.

thus placed on general practitioner services throughout the city, and on centralized diabetes services from all parts of Christchurch. The distribution of the ITDM population does vary considerably with suburbs on the western and northern fringes of the city, where much of the recent growth in the city has occurred, tending to have fewer ITDM individuals resident in their populations.

Some of this variation is directly attributable to differences in the population size of these area units. The absolute frequency of individuals with ITDM is important in terms of anticipated service requirements and doctor caseloads, but per capita rates better indicate the relative occurrence of this disorder within local communities. The community prevalence rates of ITDM per 1000 population are therefore mapped in Figure 9.10 (listed in Appendix E.3).

Prevalence was lowest in the green belt area of Paparua being measured at 1.6 ITDM persons per 1000 residents. The western and northern peripheral suburbs with smaller diabetic populations were also under-represented on a per capita basis. Riccarton and the Woolston-Ensors area stand out as the two areas of the city that have the greatest concentrations of insulin-treated diabetic individuals. Both record prevalence rates in excess of 5 per 1000. These compare to the level of 3.5 per 1000 for the urban area as a whole. The socio-economic characteristics of these two areas are dissimilar. Riccarton Borough is of a higher social class than Woolston (26% of males aged 15 years or more being employed in professional, technical, administrative or managerial occupations compared to 11%) and its population is more elderly (16.9% aged 65 or more



**Figure 9.10:** Community Prevalence of ITDM (Rate Per 1,000). **Figure 9.11:** Proportion of ITDM Persons Aged 65 Years and Over.



years compared to 12.1%). The satellite town of Kaiapoi (prevalence rate = 4.4 per 1000) in the north and Hornby in the south (prevalence rate = 4.3 per 1000) are two other district areas of potentially high relative need.

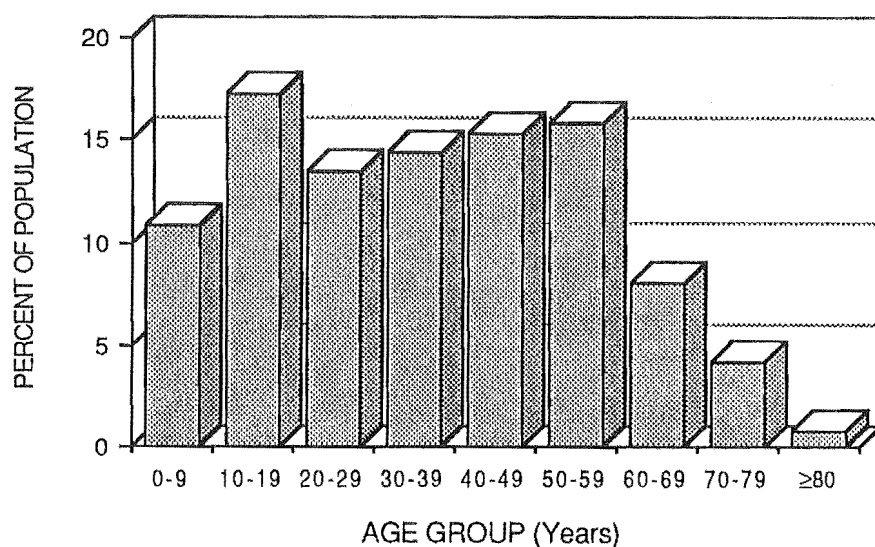
Simple and partial correlations were performed to see if any relationship existed between the community prevalence of ITDM (as indicated in Figure 9.10) and area socio-ecological characteristics. The correlation coefficients revealed no association between prevalence and the proportion of an area's population aged 65 or more years, nor between prevalence and social class (as indicated by the proportion of an area's population aged 15 or more years employed in professional, technical, administrative or managerial occupations). Social class did not emerge as a spatial correlate even when age was controlled for. X

Spatial variation in the age structure of the ITDM population, as measured by the proportion of individuals who are aged 65 or more years in each ITDM community, is shown in Figure 9.11. This pattern reflects in part the age structure of the city as a whole. Areas with high proportions of elderly diabetic patients form a ring around the city centre. These are well established residential areas of the city. In the outer suburbs where population development has been more recent, in the west and in Aranui-Bromley area for example, the diabetic population is much younger. The Port Hills - coastal suburbs from Cashmere round to Sumner and Lyttelton also have relatively fewer elderly ITDM individuals. Overall, 27% of the urban ITDM population were aged 65 or more years (area proportions are listed in Appendix E.3).

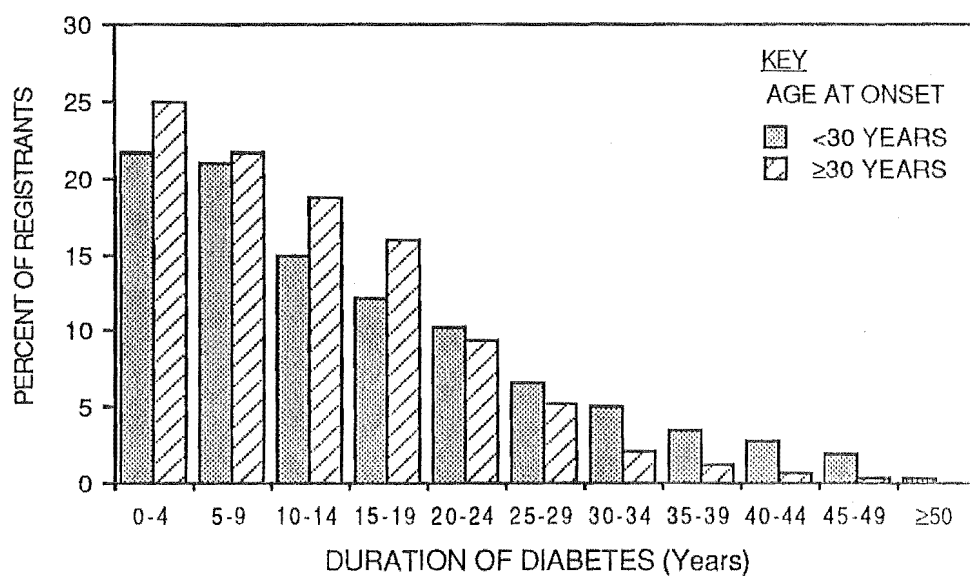
The prevalence of ITDM in rural Canterbury, at 1 January 1984, was measured at 2.3 per 1000 population. This is 50% lower than the urban prevalence rate of 3.5 per 1000. The explanation of this disparity is founded perhaps in different attack rates through rural-urban differences in diabetes aetiology, but more likely, from population differences in age-sex structures and the relocation of people from rural areas into Christchurch through life cycle changes. The mean age of ITDM persons living in rural areas was 46.1 years compared to 49.1 years for those living in Christchurch, with 17.7% of the rural population being under 20 years of age (c.f. 10.3% Christchurch residents). There were, however, similar proportions of elderly patients in both groups. Typical of rural areas, there was a bias towards males in the ITDM population (68 of the 124 individuals).

### **9.3.3 Parameters of Diabetes - How Long Have They Had Diabetes?**

Age at onset and duration of diabetes are two important health parameters because they are major predictors of diabetes morbidity and mortality. These two factors were determined for 98.3 and 98.4% of individuals respectively. Overall, only 28% of the Canterbury ITDM population presented with diabetes at age less than 20 years (Figure 9.12). Peak numbers were diagnosed during puberty (age 10-14 years,  $n = 107$ ) with numbers steadily rising thereafter up to 60 years of age. Age at onset ranged from infancy to 91 years, with a mean of 35.5 years. Diagnosis spanned all ages for both males and females.



**Figure 9.12:** Age at Onset of Diabetes.



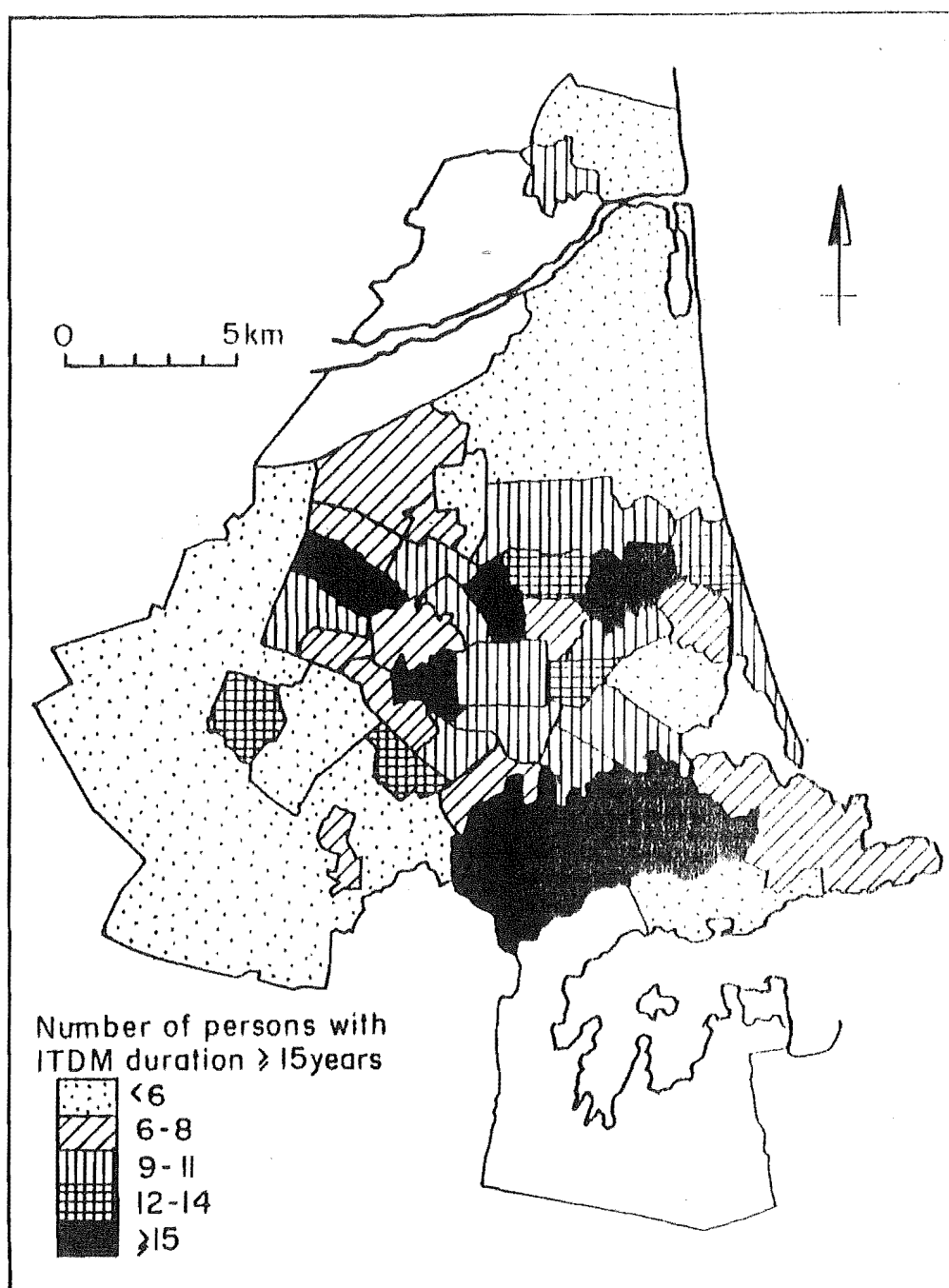
**Figure 9.13:** Duration of Diabetes (As at 1 January 1984).

Of those diagnosed in adulthood, only 17% ( $n = 142$ ) did not commence insulin therapy at diagnosis. The median age at onset of diabetes in these individuals was 50 years, with an average time delay before initiation of insulin of 9 years. Thus, the majority of individuals were diagnosed in adulthood, with over 80% of these persons commencing insulin as primary diabetes therapy at diagnosis. This supports the concept that Type I (auto-immune) diabetes occurs across all age groups, and is not just a disease of youth.

The mean duration of diabetes, at the Register prevalence date for the 1130 individuals, for whom the date of diagnosis was known, was 14.1 years (males  $13.6 \pm 0.4$  years, females  $14.6 \pm 0.4$  years). Many individuals have durations of diabetes in excess of 15 years (38%, Figure 9.13). While all patients are prone to the complications of diabetes, it is the individuals with diabetes over 15 years who are at risk to the long-term chronic complications of the disorder. Thus, this group are potentially high users of hospital services.

No individual identified on the Register had a duration of diabetes beyond 60 years, and indeed, few registrants had survived diabetes for more than 30 years. The degree of excess mortality for either those diagnosed under 30 years of age, or over, is indeterminable from this data. However, the graph does suggest premature death.

Recently diagnosed individuals represented a small proportion of the total population. Only 45 cases (4%) had been diagnosed in the 12 months preceding the Register date, 1 January 1984. This



**Figure 9.14:** Residential Location of Persons with Long-Standing ITDM (Duration  $\geq 15$  Years).

compared to 48 in 1982, and 50 in 1981. The numbers of individuals in the population with durations of less than 5 years are not dissimilar from those diagnosed between 5 and 10 years.

The greatest number of hospital admissions are expected to occur in areas where there are either large numbers of elderly persons with ITDM or persons with long-standing diabetes. Figure 9.14 indicates the residential locality of individuals who, at 1 January 1984, had had diabetes for at least 15 years (data given in Appendix E.3). These individuals are randomly distributed within the city, although there are 5 areas with concentrations of at least 15 such persons.

Some areas (Figure 9.14) had few individuals with long-standing ITDM.

#### **9.4 SUMMARY: EPIDEMIOLOGICAL PROFILE**

The basic characteristics of Canterbury's ITDM population can be summarized as follows:

- (1) The population is elderly with age range from 2-93 years. Numbers and per capita prevalence rates peaked in the 60-69 years age-group. Only 11.1% of individuals were under 20 years of age.
- (2) There are equal numbers of males and females, although prevalence was slightly higher in males (males 3.35 per 1000, females 3.24 per 1000).

- (3) ITDM occurs in all social classes, with 25% of individuals belonging to classes II and IIIN. The majority were, however, retired.
- (4) Age at onset spanned all age groups. Over 70% of the population were diagnosed at age  $\geq 20$  years.
- (5) Over 80% of the adult onset cases commenced insulin-therapy at the time of diagnosis.
- (6) Only 4% of the Register population were recently diagnosed (duration of diabetes  $< 1$  year). Nearly 40% of the population had long-standing diabetes (duration  $\geq 15$  years), but few people survived more than 30 years duration.
- (7) The population is predominantly urban, only 10.8% of individuals resided in rural Canterbury.
- (8) Individuals resided in all parts of Christchurch urban area, but their prevalence and characteristics were spatially disparate.

All members of this ITDM population were followed over the three years, 1 January 1984 to 31 December 1986, and patterns of hospitalization during this period determined. Attrition in the Register population occurred through death ( $n = 129$  persons) and out migration from the Canterbury area ( $n = 59$ ). While these two

groups, plus the new incident cases identified in updating the Register to 1 January 1987 are of epidemiological interest, they will not be discussed here. The basic characteristics of these individuals are provided in Appendix E.4. What is of primary concern is the demand placed on hospital services by the 1984 Register population over the three year study period. Attention now turns to this.



## **CHAPTER TEN**

# **USE OF HOSPITAL SERVICES BY THE CANTERBURY INSULIN-TREATED DIABETIC POPULATION**

### **10.1 INTRODUCTION**

This chapter examines diabetes hospitalization at the local level. The Canterbury Register of Persons with Insulin-Treated Diabetes Mellitus (ITDM), described in the previous chapter, is used to identify and measure the extent of hospital use by a local diabetic population.

Hospitalization is the outcome of the occurrence of illness and health services accessibility. It can be regarded as an end-point of health care pathways. In New Zealand, the predominance of inpatient and outpatient hospital care is provided to the population on referral from medical intermediaries. Patient use of services is largely at the discretion of general practitioners operating in primary care and specialists in the secondary sector.

The overall aim of the local analysis is to explore organizational influences on hospitalization of persons with ITDM. As in the macro-level analysis, the intention is to disentangle the effects of health system factors from individual characteristics of the target population.

Two earlier studies undertaken by the author and colleagues in Christchurch (Scott et al, 1985; Brown et al, 1985) and a third study in Auckland (Isaacs and Scott, 1987) have shed light on patterns of diabetic discharges from hospital. Because the diabetic catchment population was not known, these were through necessity service oriented rather than population based. In two of the three studies, the diabetic caseload of two particular general hospitals were identified, and in the third, an audit was performed on inpatient use of the four major hospitals serving the Canterbury region.

The Canterbury Register of ITDM persons does, however, provide a powerful tool for investigating hospital use by a defined diabetic population. Not only can those individuals admitted to hospital be identified but also those that were not. The extent of hospitalization of diabetic persons in the community can thus be identified and measured on a population basis. This provides comprehensive information on the demand for hospital services whilst overcoming problems inherent in service-based approaches to measuring hospitalization (Barnes, 1982). Until the development of the Register, this method was not possible, and in fact, such an approach has only been reported elsewhere by Green and Solander (1984) in Denmark. The extent of hospitalization of diabetic persons has in general been studied infrequently.

The specific objectives of this chapter are:

- (1) To measure hospitalization of the Register population in terms of frequency of admission, length of hospital stay and medical cause of hospitalization; and

- (2) To characterize hospital use in terms of individual patient characteristics. Are certain population subgroups prone to hospitalization?

While providing valuable information on the extent and nature of hospital use by persons with ITDM, these two objectives serve a vital function in the overall aim of the local level analysis. Before examining the impact of the organizational structure of diabetes care on individual access to services and entry into the hospital sector, it is essential to understand and appreciate how many individuals within the diabetic community are being admitted to hospital, who these individuals are, and why they are being admitted. The function of the Chapter is thus to provide an outcome measure of the local diabetes health care system. Chapter Eleven then attempts to unravel the organizational processes that may give rise to these patterns.

Methods used in measuring hospital use are given in Section 10.2. The extent of hospitalization among the Canterbury ITDM population is identified in Section 10.3 and patterns of hospitalization in terms of patient characteristics are reported in Section 10.4.

## **10.2 METHODOLOGY**

Hospitalization data were obtained through the assistance of the Health Computing Services and Development Support Centre of the Department of Health, Christchurch. The approach traced use of the X

public hospital sector, over the three year study period, 1 January 1984 to 31 December 1986 inclusive, by each of the diabetic individuals identified on the Canterbury ITDM Register. This method represents the population based approach to diabetes hospitalization discussed in Chapter Seven, Section 7.2. All discharges to public hospitals attributable to the Register population were ascertained irrespective of cause of admission or place of treatment.

The method used involved interfacing the Register database with the Health Department's Query Management Facility (QMF). This was the first research application, and was therefore used as a pilot test, of the QMF system which had only been introduced into health computing services. QMF is essentially a computerized hospital patient database which allows hospital medical records departments to readily access data on individual patients.

The identification key facilitating the Register-QMF interface was the national hospital patient number. This is an identification number that is assigned uniquely to each individual using New Zealand's public hospital system. The first step was therefore to ensure that the patient numbers from both data systems identified the same individuals. Having achieved this, and correcting errors in several patient numbers on the Register, the QMF was then used to find patient numbers of registrants for whom this data had been previously missing.

When the Register population was first submitted to Health Computing Services, there were 1194 registrants in total, 952 of whom had hospital numbers. Patient numbers had not been found, or

only local hospital numbers had been identified in the remaining 242 cases. A search by name was conducted, with the demographic and residential information produced through the QMF search being cross-matched with the Register data to pick-up additional patient numbers.

After all corrections and deletions had been made to the Register database, the Register population was finally enumerated at 1148 persons, as discussed in Chapter Nine. In total, 1040 individuals were identified as having active national hospital patient numbers. It is assumed that 108 individuals have not come in contact with the public hospital system in recent years, and not during the three year study period 1 January 1984 to 1 January 1987. X

Using the national patient numbers, hospital use data from the National Health Statistics archives were accessed for the 1040 active cases. The computer programme (written by John Harper of the Health Department's Computing Services) took each patient number consecutively, searched the national archive file for discharges listed for that individual for the years 1984, 1985 and 1986 and produced data output in hard copy. This output was in two sections. The first simply listed registrants for whom no event was recorded during the study period.

The second was a detailed printout of all the hospital events attributable to the Register population. Discharges were listed by patient. Basic socio-demographic data were recorded once for each patient. Information was then reported on a comprehensive range of variables for each discharge event. These included hospital, and

hospital board discharged from, dates admitted and discharged, length of stay, source of referral into hospital and admission type, and cause(s) of admission which included A to D diagnoses with both ICD codes and descriptions being given. Some additional data (e.g. on operations) were produced but this is not applicable to the current investigation.

Causes of admissions were recorded on the basis of the primary and all secondary diagnoses listed. Nine categories were identified: three pertained specifically to diabetes (ICD Code 250 but not otherwise specified, hyperglycaemia and/or ketoacidosis, hyperglycaemia); five related to the known long-term complications of diabetes although associations between the actual primary morbid events and diabetes cannot necessarily be established (renal, ophthalmic, cardiovascular including strokes, peripheral vascular and neuropathic disorders); and finally a miscellaneous category for seemingly unrelated events (e.g. fractures, trauma, malignancies, elective surgery). This diagnostic classification is similar to the coding techniques used by Connell et al (1984), Scott et al (1985), Brown et al (1985) and Isaacs and Scott (1987).

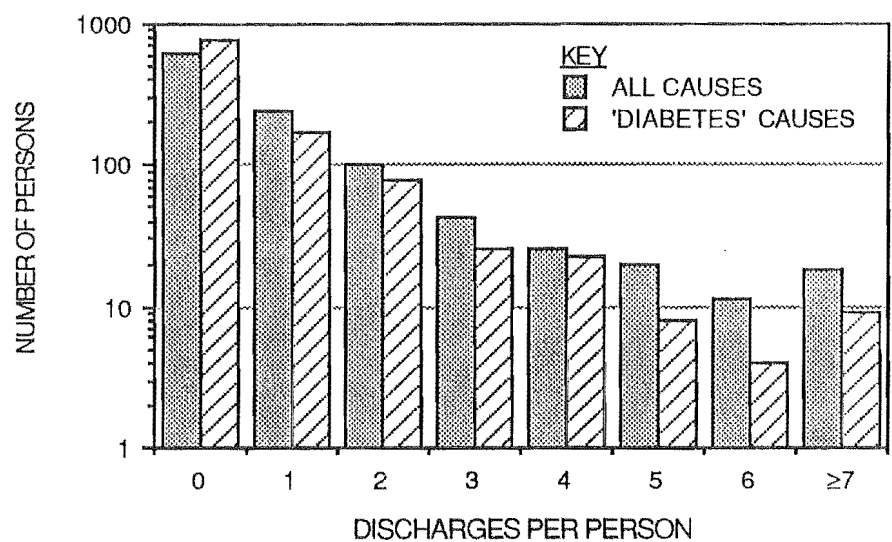
Hospitalization of the Register population was measured over the three year period 1 January 1984 to 1 January 1987. Fifty nine persons moved out of the study area during this time and these people were therefore excluded from the analyses (see Appendix E.4 for their demographic characteristics). Of the 1089 permanent residents, 129 died during the study period. As many of these individuals placed demand on hospital services for much of the study period prior to their death, they remain within the database.

Possible effects of their inclusion on the results is recognized but it was felt that their omission was more problematic and introduced a serious bias into the overall analyses. The characteristics of those individuals are also given in Appendix E.4.

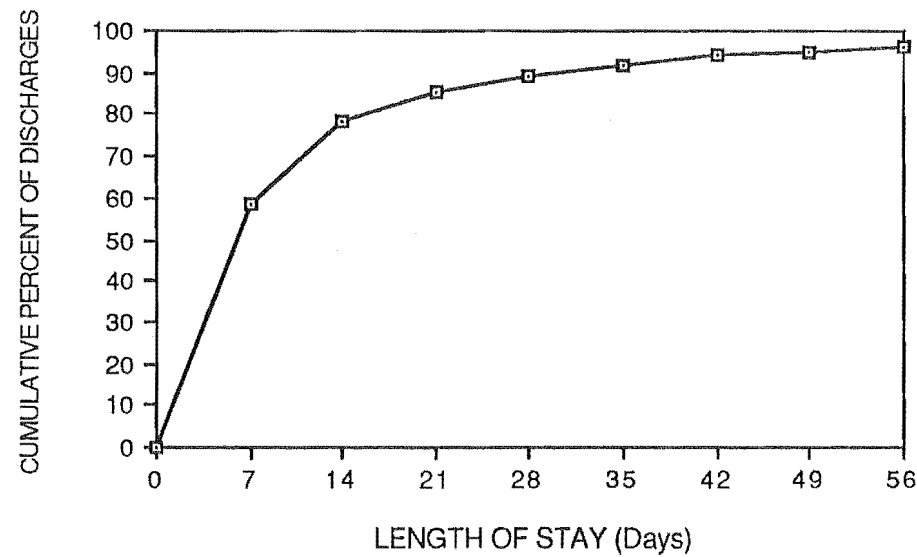
### **10.3 EXTENT OF HOSPITAL USE**

Frequency of hospital discharge of persons for all causes, and for those causes related directly to, or possibly associated with, diabetes, is shown in Figure 10.1. Overall, 629 individuals (57.8%) had not been admitted to hospital at all during the three years. An additional 138 persons, were admitted at least once for non-related causes, but had not been hospitalized for illnesses associated with diabetes. Of the 322 persons admitted for diabetes causes (specified shortly), 54% were hospitalized on one occasion only, and 22% averaged at least one hospital visit per annum over the three years. The maximum number recorded for a single individual was 17 admission episodes.

The 460 individuals hospitalized during the three years, irrespective of cause of admission, contributed to a total of 1009 admission events. The 322 persons admitted for diabetes related causes had in total 652 diabetes admissions. Thus, 30% of the Register population were hospitalized for diabetes at some stage during the three year study period, that is, one individual in every ten became a hospital inpatient per annum for diabetes-related causes. The actual "diabetes" admission rate is twice this given the number of re-admissions accruing to these individuals. The discharge rate, discounting for deaths in the population, measured 24 discharges per



**Figure 10.1:** Frequency of Hospitalization of Persons with ITDM.



**Figure 10.2:** Length of Hospital Stay for Diabetes Related Causes.



100 persons in 1984 and 20 per 100 in both 1985 and 1986. The total hospital use rate increases to one admission per three persons per annum if all events for all causes are counted.

Length of hospital stay for the 652 diabetes-related admissions ranged from 1 to 365 days. Figure 10.2 gives the cumulative distribution of these discharges by length of stay. Half of the admissions had durations of 1 week or less, 12.7% involved only one-day stays. The bulk of diabetes admissions are of a short stay nature, but some involve a prolonged stay in hospital (Figure 10.2). Approximately 10% exceeded one month, and 4% were over 8 weeks. The skewed distribution produces a mean of 13.5 days although the median is 6 days.

These 652 admission events contributed to 8767 days being spent in hospital by the Register population between 1 January 1984 and 31 December 1986 for diabetes related causes. Overall, those individuals contributed to 13,122 patient days irrespective of cause of admission (Table 10.1). Only 4 admissions occurred outside the Canterbury Hospital Board area and these involved only 8 days in total. Thus, on average, on any one day during the study period, 8 beds would have been occupied by insulin-treated diabetic persons with some problem associated with diabetes. Another 4 beds were occupied by ITDM persons admitted for reasons apparently unrelated to diabetes, and these individuals would require medical and nursing support care for their diabetes during their hospital stay.

Over the study period, the mean number of surgical, medical, paediatric and geriatric beds occupied per annum in Canterbury was

1090 beds. Twelve of these were filled by members of the ITDM population on any one day. This level of bed occupancy is far in excess of that expected from the prevalence of the disorder in the community alone. Given that Canterbury hosts approximately 10% cross-boundary travel, and the prevalence of ITDM is 3.3 per 1000 (Chapter Nine), it would seem hospital utilization by these individuals is 3-4 times that of the general public. The few admissions ( $n = 27$ ) with length of stay greater than 8 weeks contributed to 33% of total days stay for diabetes causes.

Reasons for hospitalization and extent of hospital use are shown in Table 10.1. Of the total 1009 discharges, 357 (35.4%) were caused by conditions with no apparent association with diabetes, elective surgery, fractures, malignancies, and trauma for example. In contrast, disorders of diabetes control contributed to a total of 226 discharge events in the three years (22.3%). These hospital episodes include those discharges identified under the ICD Code 250 (see Appendix C.1). This category makes no specific mention of diabetes complication, but having examined secondary diagnoses, these events appeared most likely to be precipitated by disorders of control particularly hyperglycaemia and infection (see Chapter Five for explanations). Diabetic ketoacidosis was not identified as a separate entity and is included in the 90 admissions for hyperglycaemia. Hyperglycaemia contributed to a further 6.0% of hospital events, but is noted for having very short lengths of stay. Half of the patients were hospitalized for only one or two days. Overall, these three causes involved a total of 1733 patient days spent in hospital by the Register population between 1984 and 1986.

**TABLE 10.1**  
**HOSPITAL UTILIZATION BY INSULIN-TREATED DIABETIC**  
**PERSONS 1984-1986 BY CAUSE OF ADMISSION**

Cause	Discharges:			Days Stay:			
	Number	%	Total	%	Mean (SE)	Median	Range
Diabetes							
Unspecified	75	7.4	777	5.9	10.4 (6.9)	5.0	1-170
Hyperglycaemia	90	8.9	732	5.6	8.1 (1.0)	5.5	1-58
Hypoglycaemia	61	6.0	224	1.7	3.7 (0.8)	2.0	1-44
Renal	39	3.9	425	3.2	10.9 (2.6)	5.0	1-76
Eye	59	5.9	398	3.0	6.7 (0.7)	6.0	1-27
Cardiovascular	200	19.8	2582	19.7	12.9 (1.7)	7.0	1-229
P.V.D.	109	10.8	3265	24.9	30.0 (6.8)	17.0	1-365
Neuropathy	19	1.9	364	2.8	19.2 (4.3)	9.0	1-75
Non-Related	357	35.4	4335	33.2	12.3 (1.0)	6.0	1-159
Total	1009	100.0	13122	100.0	13.0 (0.8)	6.0	1-365

SE is Standard Error of the Mean.

These disorders of glycaemic control are potentially preventable through interventive strategies and diabetes management practices currently operating in the community. While it would be unrealistic to expect to be able to prevent all such admissions, this level of hospitalization involving the acute complications of diabetes seems to indicate a problem with the quality of care and inappropriate use of ambulatory services for a significant number of individuals.

Given the age structure of this population and the risks to health, it was not surprising to note that the most common cause associated with the long term complications of diabetes was cardiovascular disease - stroke. This accounted for one fifth of all admissions and days stay by the Register population.

Peripheral vascular disease (P.V.D.) is most notable for its prolonged length of hospital stay. A significant proportion of the 109 discharges involved lower limb amputations and these contributed to extended durations of stay. A smaller proportion (1.9%) of discharges were attributed to neuropathy as the prime cause of hospitalization.

The impact of diabetic retinopathy and renal disease on this population is also evident from Table 10.1. Over the course of the three years, there were 98 such admissions. These typically involved short stays in hospital with over 50% being under a week in duration. Like all the other causes, length of stay was skewed. There was, overall, a statistically significant difference in length of stay by these primary causes of admission (ANOVA,  $p < 0.001$ ). Admissions for

hyperglycaemia and eye disease have the shortest average length of stay (ALOS), and neuropathy and P.V.D. the longest.

Since the interest of the thesis is diabetes, or more particularly diabetes care, attention will henceforth focus on the admission events involving disorders of diabetes control are associated directly or indirectly with the long-term complications of diabetes. Thus, the 357 discharges identified as being caused by reasons apparently unrelated to diabetes morbidities will be excluded from the discussion.

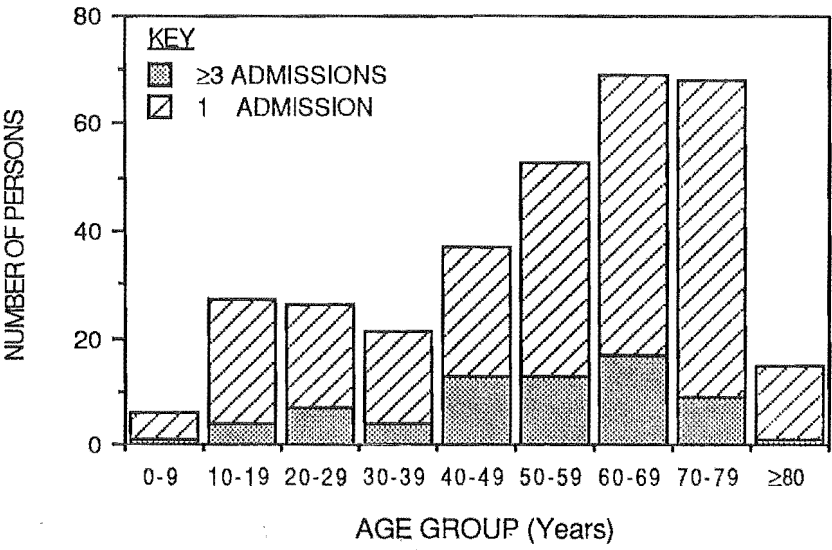
## **10.4 WHO IS BEING ADMITTED AND WHY?**

### **10.4.1 Demographic Characteristics**

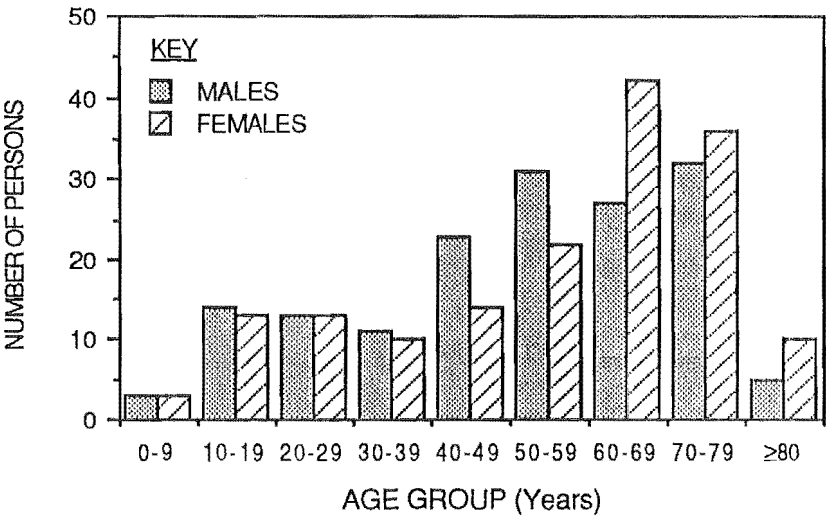
Of the 322 individuals hospitalized for diabetes-related causes, 163 were female and 159 male. This means 30.1% of the female ITDM population were hospitalized at some stage during the study period, and 29.0% of the males. Females contributed to 302 discharge events and males 350. Thus, hospitalized males averaged 2.2 admissions each and females 1.9. However, a  $\chi^2$ -test revealed no statistical difference in the likelihood of males or females being multiple-admitters. Overall, the annual rate of hospital discharge for males in the ITDM population was 21.3 per 100 males compared to 18.6 discharges per 100 females. There was no statistical difference in ALOS for males (13.8 days), and females (13.0 days) and both had median length of stay of 6 days.

A key determinant of hospital use at the individual level is age. The average age of the 322 individuals admitted to hospital, as at the Register prevalence date 1 January 1984, was 53.2 years. This compared to 48.0 years for persons not hospitalized during the course of the study period. The age structure (as at 1 January 1984) of the 322 persons hospitalized is shown in Figure 10.3. This also identifies multiple admitters who averaged at least one admission per annum. Clearly individuals of all ages are prone to hospital admission (age range 3-90 years). However, nearly 50% were aged 60 years or over. The 69 individuals hospitalized on at least three occasions were predominantly middle-aged, although ages similarly ranged from childhood to old-age. As expected from general patterns of hospitalization, males outnumbered females in the middle age groups, and females outnumbered males in the older age groups (Figure 10.4). The mean age of the 159 males who were hospitalized was 51.7 years and the 163 females 54.7 years.

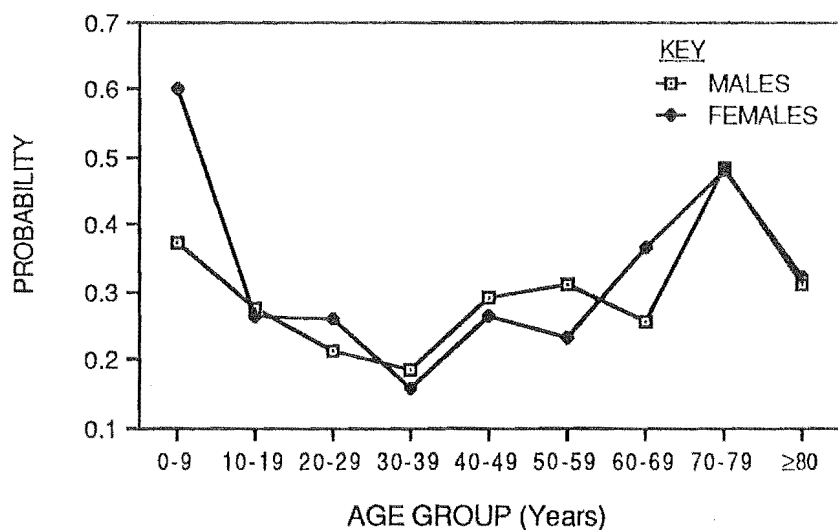
The likelihood of a registrant in a given age-group at the start of the study period being hospitalized, irrespective of how often, during the three years is shown in Figure 10.5. Females under 10 years of age have the highest propensity for hospital admission. Three of the five girls in this age-group were hospitalized at some stage during the study period for diabetes related causes. Young boys similarly had a high likelihood of hospital admission (3 out of the 8 were hospitalized). While these are small numbers and therefore subject to large fluxes, these findings confirm the general observation that diabetic children are prone to hospital admission.



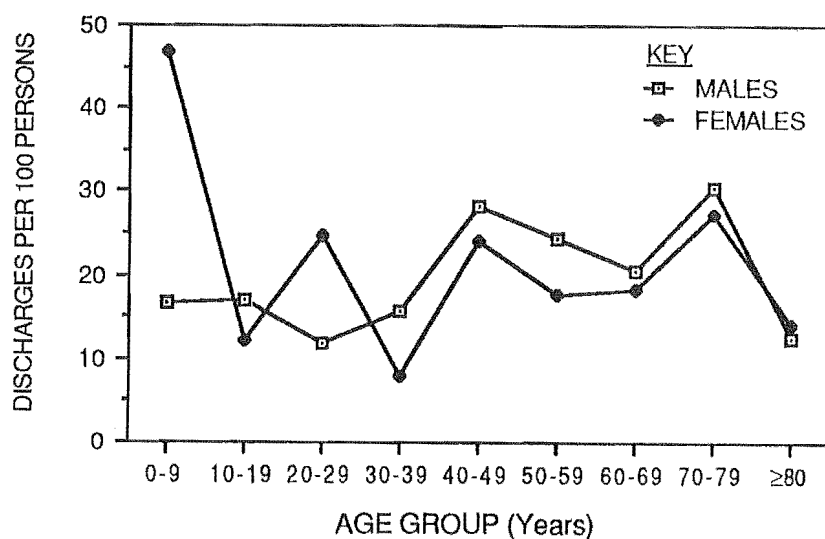
**Figure 10.3:** Age Structure of Individuals with ITDM Hospitalized During 1984 - 1986.



**Figure 10.4:** Age Structure of Individuals with ITDM Hospitalized During 1984 - 1986 by Sex.



**Figure 10.5:** Proportion of Individuals with ITDM Hospitalized During 1984 - 1986.



**Figure 10.6:** Annual Discharge Rate Per 100 Registrants by Age Cohort at 1 January 1984.



The trends between male and female are not dissimilar with younger adults (30-39 years) being least likely to be hospitalized. Probability of hospitalization subsequently increases especially for the elderly. If an individual survives into their eighties then his/her likelihood of being hospitalized drops to levels recorded for individuals of younger age groups.

Figure 10.6 identifies annual discharge rates by age group. This includes both first admissions and re-admissions attributed to each age-group. Again the registrants' ages at 1 January 1984 are used to define the age cohorts. While the different age cohorts had different propensities to being hospitalized, differences in rates of re-admission of each age group obscure age differences in terms of annual discharge rates. Perhaps the only major trend to emerge in discharge rates is an apparent dichotomy between those aged less than 40 years and those aged 40 or more years. The annual discharge rate for the former is 15 discharges per 100 persons compared to 22 discharges per 100 persons in the older age groups. This is most noticeable in males. Females in their twenties, for example, had a relatively low probability of being admitted to hospital but those that were ( $n = 13$ ), averaged 2.8 admission events each, hence the peak in the annual discharge rates.

The pattern revealed in Figure 10.6 is not typical of the trend in hospital admission rates by the age and sex for the population at large (Hyslop et al, 1983). This latter pattern is "U"-shaped similar to that in Figure 10.5. Diabetic individuals in middle age appear to have more re-admissions relative to both the young and elderly. In fact those ITDM individuals aged between 30 and 60 years who were

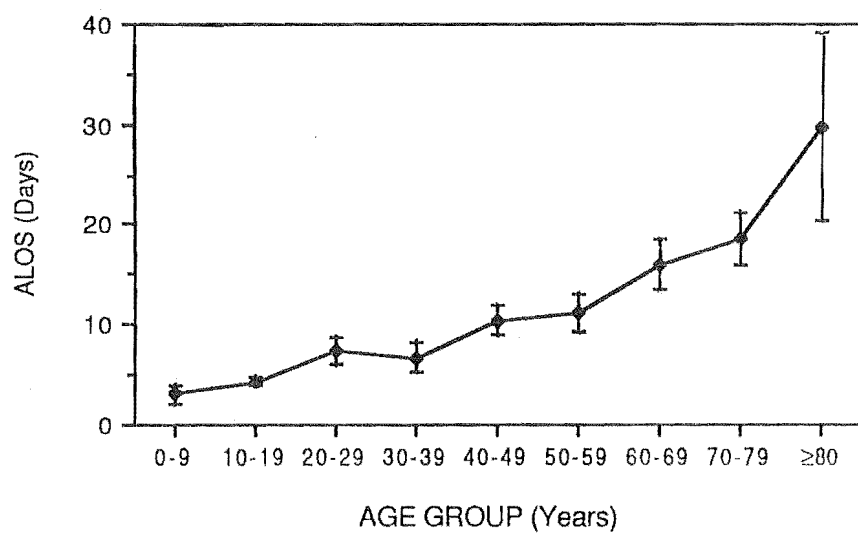
admitted to hospital averaged 2.4 admission events each, compared to 1.9 in youth and 1.8 in superannuitants. This situation may very well reflect the duration of diabetes and occurrence of the long term complications. This will be explored shortly.

Not unexpectedly, length of hospital stay increases with age (measured as age at time of admission). This is shown in Figures 10.7 and 10.8. There was a statistical difference in ALOS by age groups (ANOVA,  $p < 0.01$ ) with individuals under 20 years of age staying on average for less than a week, those between 20 and 60 years of age at admission a week to a fortnight, and the elderly had ALOS exceeding a fortnight. Length of hospital stay did however vary considerably, especially for elderly persons.

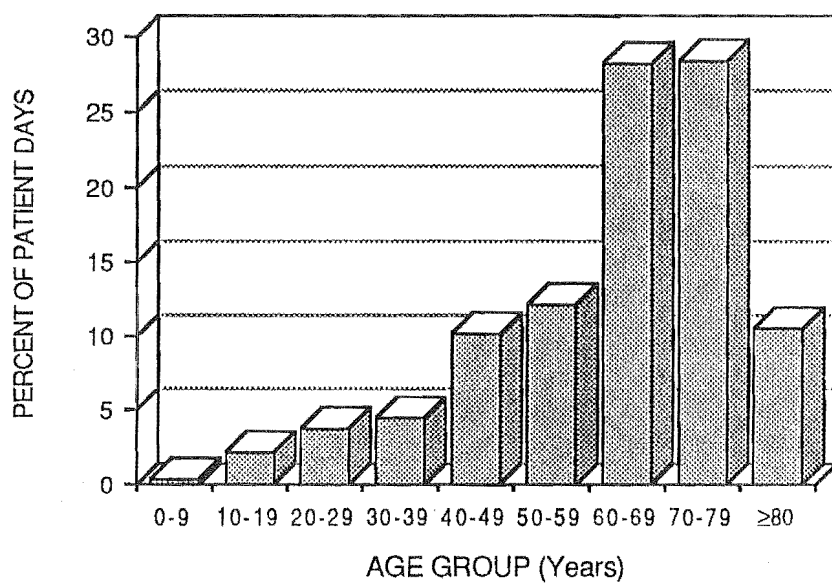
Overall, it was individuals in their sixties and seventies who were responsible for the greatest proportion of bed days. They spent a total of 4972 days in hospital in the three years for diabetes-related morbidities. In contrast, persons under 20 years of age contributed to only 2.4% of the total days stay incurred by the Register population.

#### **10.4.2 Social Class and Rates of Hospital Use**

The role of social class factors as predictors of hospitalization were unclear at the regional level. Patterns of diabetes hospitalization in terms of the social class factors of marital and occupational status at this level of analysis tend to reflect the demographic characteristics of the ITDM population. There are,



**Figure 10.7:** Average Length of Stay ( $\pm$  SEM) By Age of Patients, at Admission.



**Figure 10.8:** Proportion of Total Days Stay by Age of Patients at Admission.

however, some social class differences in rates of hospital use as indicated in Tables 10.2 and 10.3.

The most noticeable feature is persons with ITDM who are divorced or separated, and who are not in stable relationships (de facto partnerships are regarded as the same as being married) are prone to hospitalization (Table 10.2). In the three year study period just over 4 in every 10 of these individuals were admitted to hospital and those who became inpatients averaged 1.9 admissions each. While ALOS and <sup>ave. length of stay</sup> per capita days stay were less than for married individuals, this latter group has a high proportion of elderly persons (50% aged  $\geq 60$  years) who typically stay longer than those in middle age, the age-category most of the divorced or separated individuals come into (67% aged 40-60 years).

The possible suggestion that those from a "disrupted" social background are disproportionate users of hospital services is reinforced to a certain extent by the findings in Table 10.3. Apart from superannuitants, individuals belonging to the lower social classes V (unskilled occupations) and B (which largely comprises those who are unemployed or on some kind of welfare benefit) were most prone to admission, re-admission, and in the case of class B members, prolonged hospital stay.

While only five members of the upper social class were hospitalized in the three years, they contributed to a total of 13 discharges, and thus to moderately high per capita rates of admissions and patient days stay for this group as a whole. In contrast, those in class IV (partly-skilled) had a low propensity for

**TABLE 10.2**  
**DIABETES HOSPITALIZATION 1984-1986 BY**  
**MARITAL STATUS OF ITDM POPULATION**

Marital Status	No. of Persons Admitted	% From Marital Class	Number of Discharges	Discharge Rate Per 10 Persons	ALOS (SE)	Patient Days Per 10 Persons
Single	65	29.7	125	5.7	8.7 (1.5)	49.5
Married	173	28.5	375	6.2	13.4 (1.2)	82.3
Widowed	66	38.6	118	6.9	20.1 (3.7)	138.4
Divorced/ Separated	18	43.9	34	8.3	9.1 (2.2)	75.9

SE is Standard Error of the Mean.

**TABLE 10.3**  
**DIABETES HOSPITALIZATION 1984-1986 BY OCCUPATIONAL**  
**STATUS OF THE ITDM POPULATION**

Occupational Class	No. of Persons Admitted	% From Occupational Class	No. of Discharges	Discharge Rate Per 10 Persons	ALOS (SE)	Patient Days Per 10 Persons
I	5	23.8	13	6.2	9.2(3.0)	56.6
II	24	19.8	52	4.3	7.2(1.2)	31.1
IIIN	29	24.8	61	5.2	9.0(1.1)	46.8
IIIM	22	26.8	29	3.5	11.9(3.1)	43.0
IV	14	21.5	20	3.1	4.9(0.7)	15.1
V	21	29.6	63	8.9	6.6(1.4)	58.2
Super-annuitants (A)	172	37.3	331	7.2	17.8(1.9)	127.7
Bene-ficiaries (B)	20	34.5	48	8.3	13.5(4.2)	111.1

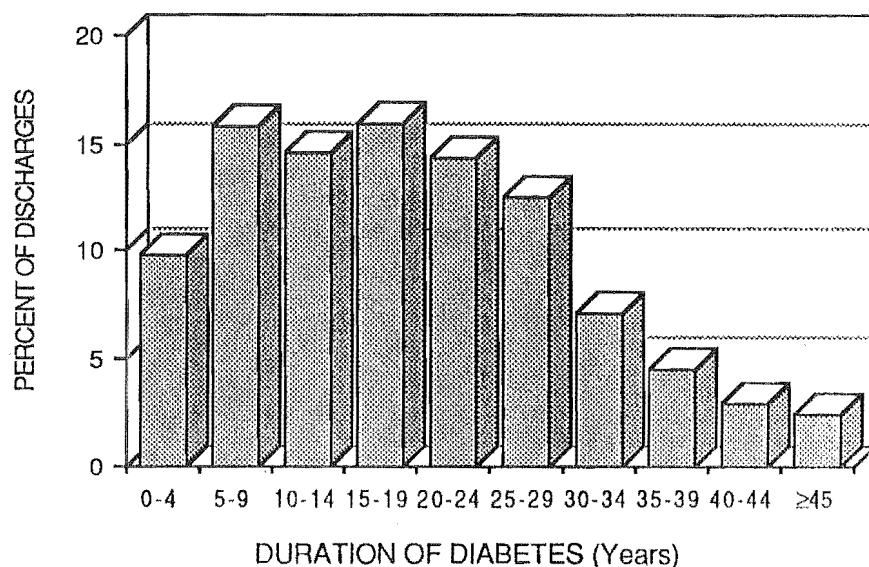
**Note:** See Chapter Nine for definitions of occupational classes.  
Occupational status missing for 15 individuals  
hospitalized and 35 admission events.  
SE is standard error of the mean.

hospitalization, few re-admissions and short hospital stays. The age of the 14 individuals who were hospitalized in this class ranged however from 12 to 59 years, and 8 were aged between 15 and 35 years (as at January 1984). These age groups tended towards low hospitalization rates.

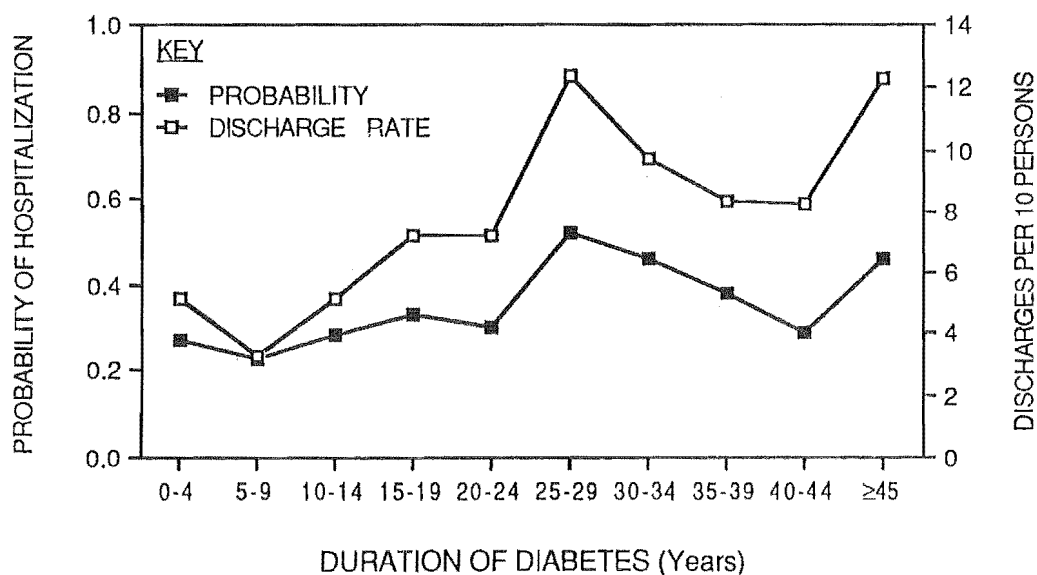
#### **10.4.3 Duration of Diabetes and the Need for Hospital Care**

Since duration of diabetes is a key factor in the incidence of the long term complications of the disorder, this variable is seen as an important individual predictor of hospitalization requirements. In addition, duration of the disorder may reflect in the confidence and ability of individuals to manage their disorder. The frequency of discharges attributed to patients with different durations of diabetes, as at the time of their admission to hospital, is shown in Figure 10.9. Very similar numbers of events accrue to individuals having been diagnosed between 5 and 30 years. About 10% of discharges involved recently diagnosed individuals (durations 0-5 years) with numbers tailing off for those with very long-standing diabetes ( $\geq 30$  years).

This pattern while indicating the hospital caseload, does not reveal relative rates of hospitalization by duration of diabetes in the population. These rates are shown in Figure 10.10 which provides the probability of an individual being hospitalized in the three years (irrespective of whether or not he/she was admitted once or a number of times) according to his/her duration of diabetes at the start of the study period, and the three year discharge rate for each cohort. Thus, while those with moderate lengths of duration of the disorder are most common in the wards, they are least likely to be



**Figure 10.9:** Distribution of Discharges by Duration of diabetes at Admission.



**Figure 10.10:** Likelihood of Individuals Being Hospitalized and Rates of Discharge By Duration of Diabetes.



admitted on a per capita basis and contribute to fewer admission episodes per capita.

Individuals who had been diagnosed between 25 and 35 years, or 45 and more years had the highest risks to hospitalization and multiple admission. Recently diagnosed individuals placed greater demand on hospital services than expected from their occurrence in the population than those diagnosed between 5 and 9 years and have a similar level of use to persons with diabetes durations between 10 and 14 years (Figure 10.10).

An ANOVA indicated that there was no significant difference between average length of hospital and the 5 year duration cohorts. Those diagnosed between 15 and 29 years did, however, contribute to 50% of total patient days.

Overall, the 322 person hospitalized for diabetes causes did have a mean duration of diabetes significantly greater than those persons not admitted (16.2 years and 13.6 years respectively as at 1 January 1984). However, people with all durations of diabetes were susceptible to hospitalization.

#### **10.4.4 Patient Characteristics and Causes of Admission**

Different sectors of the ITDM population may be admitted for different reasons. A summary of sex, patient ages and durations of diabetes at the time of admission for the eight diabetes-related causes for the 652 discharge events during the study period is provided in Table 10.4. Both mean age of patients and mean duration

**TABLE 10.4**  
**PATIENT CHARACTERISTICS AT THE TIME OF**  
**ADMISSION BY CAUSE OF ADMISSION**

Cause	Number of Discharges:		Age (Yrs):			Diabetes Duration (Yrs):		
	Males	Females	Mean	Median	Range	Mean	Median	Range
Diabetes Unspecified	24	51	49.5	54.0	4-88	16.4	12.0	1-52
Hyperglycaemia/ Ketoacidosis	38	52	42.2	43.0	5-84	17.0	14.0	2-49
Hypoglycaemia	40	21	44.4	46.0	5-81	15.5	14.0	2-40
Renal	15	24	39.6	35.0	21-78	21.1	22.0	3-43
Eye	18	41	54.9	65.0	22-86	22.4	22.0	3-48
Cardiovascular/ Stroke	121	79	62.4	61.0	33-91	16.8	15.0	1-50
P.V.D.	81	28	60.3	62.0	26-82	24.2	25.0	2-48
Neuropathy	13	6	57.6	61.0	27-85	15.8	14.0	2-29
Total	350	302	53.9	59.0	4-91	18.6	17.0	1-52

of diabetes vary significantly by cause of hospital admission (ANOVA,  $p < 0.001$ ). Disorders of control span all ages whereas the causes associated with the long-term complications of diabetes involve a much older group of individuals. The exception to this is renal admissions. Although not involving individuals under 20 years of age, half of these events were attributable to patients aged between 20 and 35 years. The three causes, renal, eye and peripheral vascular diseases, each involved patients with longer durations of diabetes.

Males and females while being at risk to each of these causes, are admitted for quite different reasons (Table 10.4). Of the 302 discharges for females, 41% involved disorders of control, especially hyperglycaemia. Females also contributed to a significant proportion of admissions for renal and eye disorders. In contrast, males had twice as many admissions for hyperglycaemia, accounted for 60% of the discharges involving cardiovascular disease and strokes, and dominated the admissions for P.V.D. three to one. Males also contributed 13 of the 19 admissions involving neuropathy.

All of the admissions attributable to individuals under 20 years of age were for disorders of diabetes control. Those in their twenties and thirties similarly were admitted for these reasons (41.6% of discharges) but with the major difference that 26.7% and 19.8% of admission events in this age group involved renal and eye disease respectively. Reasons for admission are somewhat more disparate for the middle and older age groups. Not unexpectedly cardiovascular and peripheral vascular diseases are prominent causes of admission in these age groups.

Given the age trends in causes of hospitalization, it is not surprising that most discharges for single persons involved disorders of control (68% of discharges). The ratio of hyperglycaemia/ketoacidosis/infection to hyperglycaemia was 2 to 1. As stated earlier, individuals in the ITDM population who were divorced or separated were prone to hospital admission. Hyperglycaemia (including unspecified diabetes) contributed to 44% of their admissions and hypoglycaemia another 14.7%. These two marital groups accounted for over 45% of admissions for disorders of control, twice that expected from their prevalence in the ITDM population (see Chapter Nine).

While there are specific differences in causes of admission by social class as indicated by occupational status (Table 10.5), no clear trend emerges overall. The high rates of hospitalization of individuals in Classes V and B do however appear to be attributable to multiple admissions for the disorders of diabetes control. Both of these lower classes had triennial admission rates for these perturbations of control twice the level for the population as a whole.

#### **10.4.5 Intra-Urban Disparities in Hospital Admission**

This final results section examines the spatial variation in admission patterns. Where had the inpatient population been drawn from? Attention focuses on the urban population since this comprises the majority of ITDM individuals in Canterbury. This group also accounted for 88% of the 652 diabetes associated admission episodes. Furthermore, there was no difference in the likelihood that an individual was hospitalized during the study period

**TABLE 10.5**  
**SOCIAL CLASS DIFFERENCES IN TRIENNIAL DISCHARGE RATES**  
**(DISCHARGES PER 10 PERSONS) BY CAUSE OF ADMISSION**

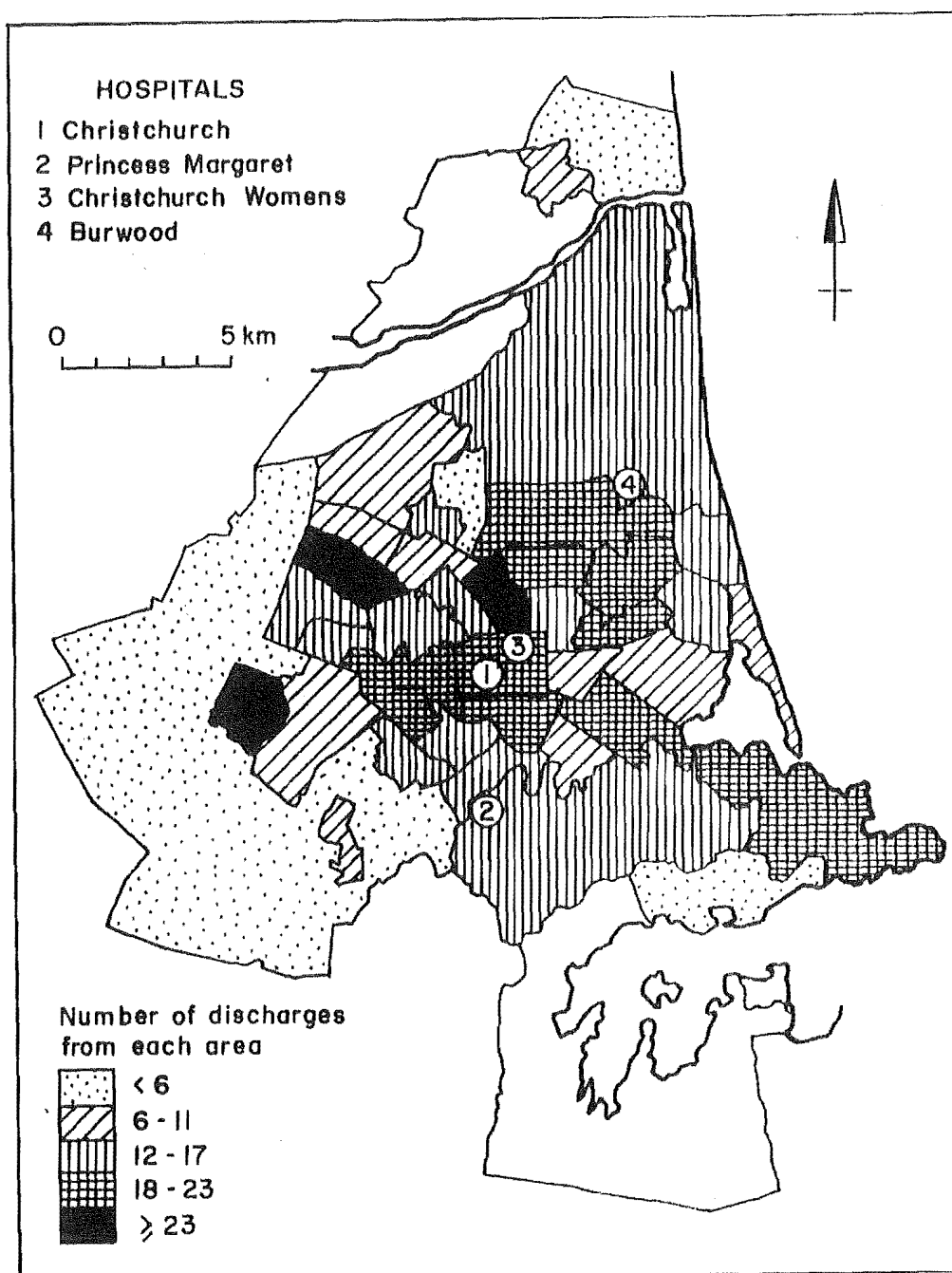
<b>Class</b>	<b>Disorders of Control</b>	<b>Renal/Eye Diseases</b>	<b>Macrovascular/ Neuropathic Diseases</b>	<b>Total</b>
I	2.9	-	3.3	6.2
II	2.1	0.5	1.7	4.3
IIIN	2.5	0.5	2.2	5.2
IIIM	1.8	0.1	1.6	3.5
IV	1.1	0.6	1.4	3.1
V	4.9	3.7	0.3	8.9
Superannuitants (A)	1.8	0.8	4.6	7.2
Beneficiaries (B)	4.0	0.9	3.4	8.3
Total	2.1	0.9	3.0	6.0

whether he/she lived in urban or rural Canterbury. In total 36 rural residents were hospitalized at some point during the three years. These individuals contributed to 77 admission events, a similar rate of re-admission to their urban counterparts.

Different local ITDM communities placed different levels of absolute demand on hospital services, and individuals living in different parts of the urban environment were more prone to hospital admission. The spatial variability in the number of hospital admissions by patient domicile is shown in Figure 10.11.

People were admitted from all parts of the city, but 70% of total admissions were attributable to people living in suburbs within a five kilometre radius of the city centre (distance measured to the area centroids). Pockets of high demand did, however, occur in some outer suburban areas.

Sites of the city's four main public hospitals have been identified on Figure 10.11 to provide an indication of the location of hospital services relative to area caseloads. These hospitals do, however, receive admissions from throughout the city, and the Canterbury area as a whole. In the order of 90% of diabetes-related admissions are jointly shared by the two large general admitting hospitals, Christchurch Hospital (with 515 available beds in 1986) located in the inner city and the Princess Margaret Hospital (321 beds) at the foot of the Port Hills to the south (Brown et al, 1985). Both hospitals share acute and elected medical and surgical admissions, except that the Princess Margaret Hospital does not admit children nor treat renal or eye disorders.



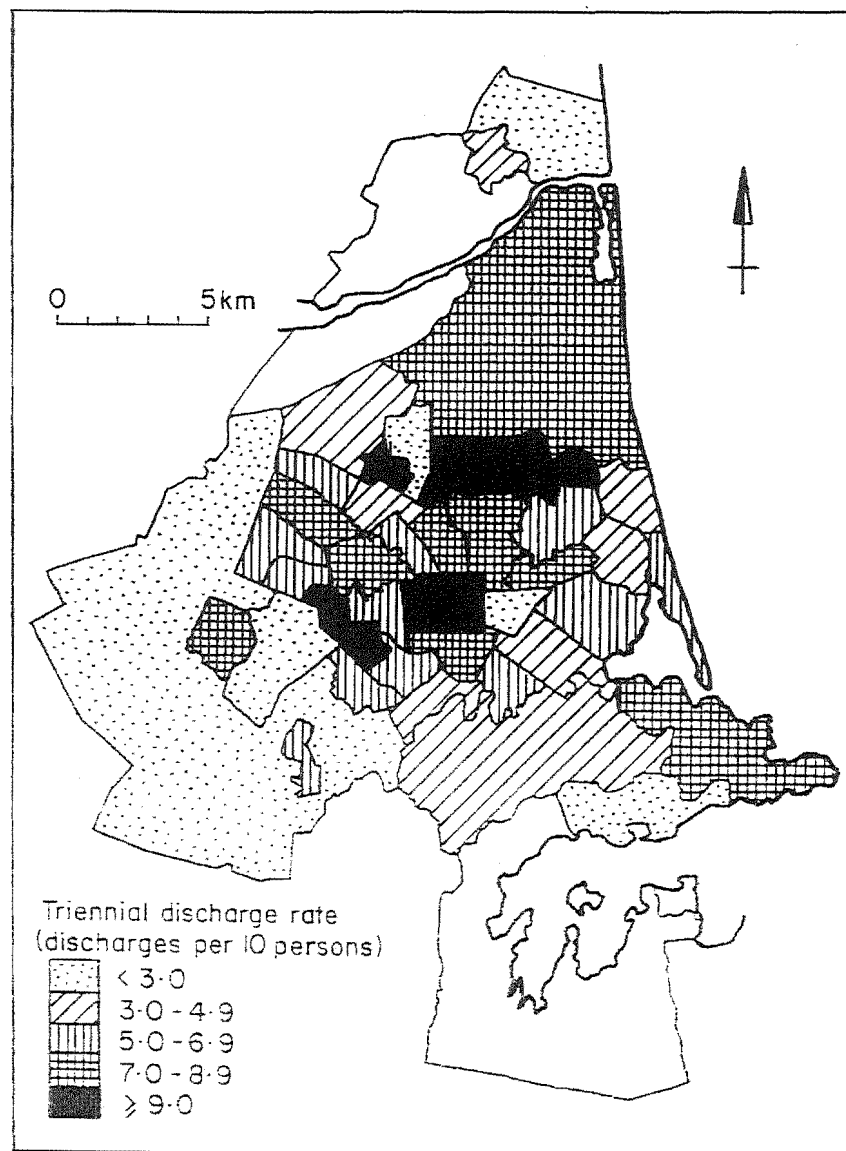
**Figure 10.11:** Spatial Variation in Hospital Use.

Figure 10.11 indicates the absolute demand placed on hospital services in terms of the numbers of admissions by patient domicile. Hornby residents, for example, contributed to 29 admission events, or 5% of admissions from people living in the urban area. This pattern may simply be a reflection of the fact that more ITDM people live in Hornby than in other areas. Per capita rates of hospital discharge, and the likelihood that an individual became an inpatient, do differ by patient domicile (Figures 10.12 and 10.13). Admissions to hospital are higher in some areas than expected from the number of ITDM persons living there. Per capita discharge rates varied from a low of 2 discharges per 10 residents to a high of 11.5 discharges per 10 residents, and the proportion of ITDM individuals hospitalized from different parts of the urban area differed four-fold (see Appendix E.3).

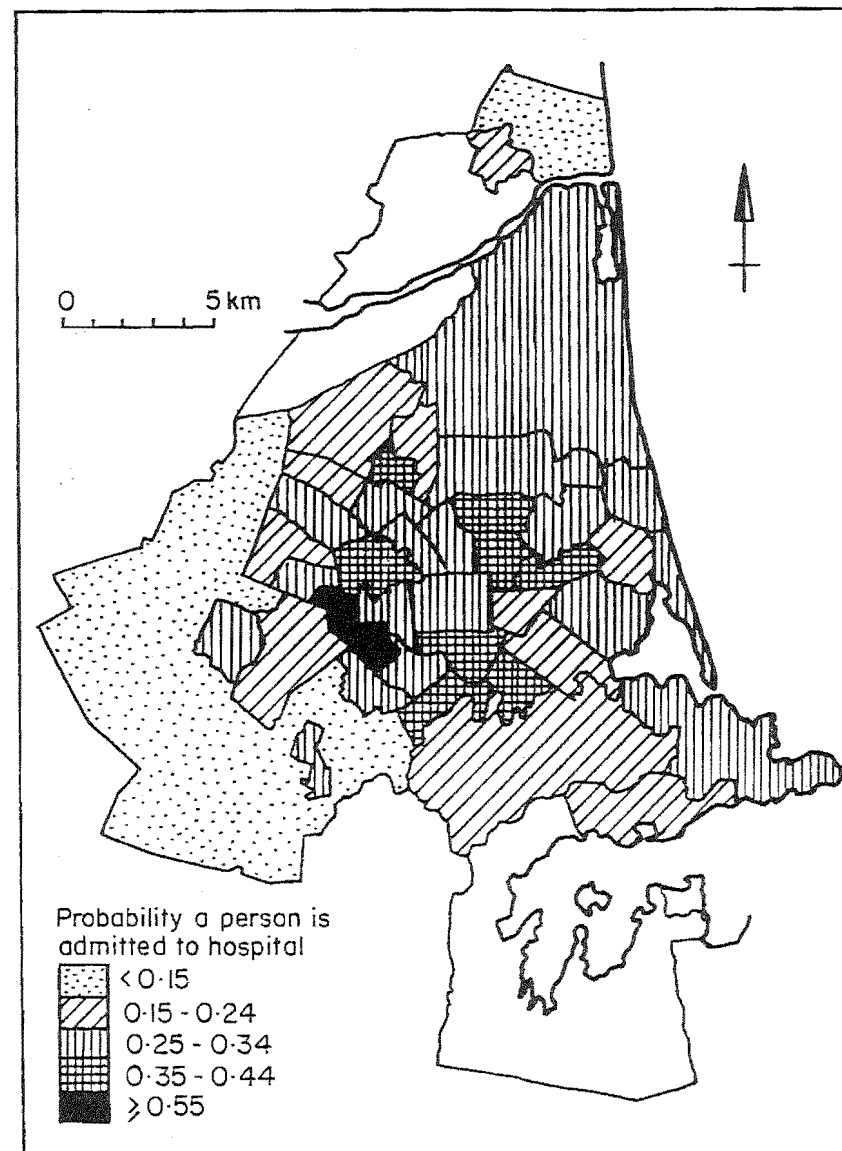
The inner suburbs (within 5 km of the central business district) are high use areas. The differences in area propensities for an individual to be hospitalized between the inner and outer areas was highly significant (33.4% compared to 23.9%; ANOVA,  $p < 0.001$ ). Differences in area triennial discharge rates between the two zones also reached significance at  $p = 0.05$  (4.8 discharges per 10 residents in the outer suburbs compared to 6.5 in the inner suburbs).

The reasons for these patterns are unclear. Spatial variations observed in hospital admission was not, in general, correlated with area variations in the characteristics of the ITDM population. This may be a function of the very small numbers of persons involved and a high degree of statistical noise. Differences between areas in the





**Figure 10.12:** Spatial Variation in Triennial Discharge Rates.



**Figure 10.13:**  
Spatial Variation in the Probability of Individuals Being Hospitalized.

proportion of persons with ITDM admitted to hospital was, however, correlated with the proportion of ITDM residents aged over 65 years ( $r = 0.387$ ;  $p \leq 0.05$ ). This also related to the overall age structure of the areas (as defined by the proportion of all residents aged 65 or more years) ( $r = 0.379$ ;  $p \leq 0.05$ ).

A comparison between area socio-economic status (% of population aged 15 years or more having professional, technical, administrative or managerial occupations) and area variations in hospital use by the ITDM population, revealed no relationship between these factors even when the age structure of areas were controlled for. While the explanation may relate to the physical accessibility of primary care services, this is unlikely.

Spatial differences in the access to general practitioners do not appear to be important factors in a small city such as Christchurch, particularly since the population is mobile. Overall, there is little difference in the physical accessibility of general practitioner services in Christchurch (Sheerin and Barnett, 1981) and differences in the availability of doctors appear to have been eroded in recent years. In addition, Sheerin and Barnett (1981) identified the outer suburbs as areas with low levels of physical accessibility to general practitioners. These areas had low rates of hospital use by the ITDM population which is counter to that expected if physical inaccessibility was an important factor. Any difference in the use of primary care services is more likely to reflect barriers to care imposed by social class factors than spatial access to doctors.

## 10.5 DISCUSSION AND CONCLUSIONS

This study has measured and described use of hospital inpatient services by the Canterbury Insulin-Treated Diabetic Population. The research involved a complete follow-up of individuals entered onto the Canterbury ITDM register at the prevalence date 1 January 1984. The extent of hospital use, irrespective of cause of admission and place of treatment during the three year period 1 January 1984 to 31 December 1986, was measured for each member of the population (results presented excluded data on the 59 out-migrants). The importance of this population based approach is that it provided essential epidemiological data from which rates of hospitalization could be determined and groups within the diabetic population at risk to hospital admission identified.

Overall, the data showed a high risk of hospitalization amongst diabetic persons. One in every ten individuals was hospitalized each year for causes related directly to diabetes or concomitant with the disorder. Re-admission was common to many patients although not characteristic of any one group. In total, 460 individuals were hospitalized in the three years (42.2% of the population) and these individuals contributed to 1008 admission events. However, 138 of these persons were admitted for reasons apparently unrelated to diabetes morbidities. The 322 individuals hospitalized for causes directly, or possibly implicated with diabetes, contributed to a total of 652 discharges. This equates to an annual discharge rate of 20 discharges per 1000 persons with ITDM.

Length of hospital stay varied considerably, particularly by cause of admission and patient age. The mean duration of hospital stay for "diabetes" causes was 13.5 days with no difference being observed between males and females. Whilst, the ITDM population accounted for 4.0 days stay per person per annum for all causes, and 2.7 days for diabetes associated reasons, a relatively small proportion of admission contributed to a large number of patient days. Half of the admission events involved stays of less than one week, but 10% involved prolonged hospital stays in excess of one month.

Frequency of hospitalization combined with length of stay contributed to over-representation of the diabetic population in the hospital inpatient population as a whole. Bed occupancy was three to four times that expected from the prevalence of the disorder within Canterbury's general population. Disproportionate use of hospital services by insulin treated diabetic individuals relative to the general population was also reported by Green and Solander (1984) in Denmark. The Frederica Study also undertaken in Denmark, similarly noted excessive levels of hospitalization of elderly diabetic patients (Damsgaard et al, 1987).

There is considerable heterogeneity in the characteristics of the ITDM persons using hospital services. There is no rural-urban difference in admission rates. While demand is placed on hospital services from all parts of the city, there is considerable intra-urban disparity in the absolute frequency of hospital admissions, in localized admission rates, and in the proportion of a local residents that were admitted to hospital. This does not appear to be a function of spatial inaccessibility of primary care services.

Those ITDM persons being admitted to hospital were on average older and had longer durations of diabetes than those individuals remaining within the community. Age of patients at admission did, however, span all age groups. The predominant user group in absolute terms were the elderly. Individuals aged 65 or more years were large in number and they stayed in hospital for prolonged periods of time. Older patients were particularly at risk to vascular problems which may or may not have been provoked by their diabetes.

The relationship of diabetes, especially insulin-dependent diabetes, to blindness, renal failure, lower limb amputation and heart disease is well recognized. The causes of admission incorporating these problems typically involved persons with long-standing diabetes. A spectrum of diagnoses did prompt admission, however, with 35% of all discharges attributable to the ITDM population being precipitated by conditions unrelated to diabetes - elective surgery, trauma, malignancies, fractures etc.

Of the 652 events caused directly by diabetes, or with possible association to the disorder, 35% were precipitated directly through perturbations in glycaemic control. Disorders of control were the predominant cause of admission of persons under 40 years of age, and especially of admission of children and adolescents. This finding strongly supports Fishbein and colleagues (1982) data from Rhode Island that poor diabetes control is the major factor in hospitalization of insulin-dependent diabetic persons under 30 years

of age. On a population basis, young diabetic individuals were at high risk to hospital admission.

Furthermore, the only significant social class factor to emerge suggests those individuals in less fortunate social circumstances, through marriage break-ups or limited employment opportunities for example, are prone to hospital admission through poor diabetes control. While there was little or no differences in rates of hospital use between males and females, there were notable differences in cause of admission. In particular, over 40% of the "diabetes" admissions for females involved disorders of control, especially hyperglycaemia.

These findings suggest certain members of the ITDM population - in particular children and young adults, those in limited social circumstances and females - find it difficult to successfully implement self-management skills and principles, lack confidence or are non-compliant with therapeutic regimes, or have limited access to appropriate forms of diabetes care which would assist in improving their diabetes control, and thus minimize their requirements for hospitalization in the short and long terms.

Clearly, insulin-treated diabetic individuals are major users of hospital inpatient resources. It is the task of Chapter Eleven to investigate these patterns of hospitalization in relation to the local organization of diabetes services, and in particular to characteristics of local general practitioners and specialist diabetes ambulatory services.

## **CHAPTER ELEVEN**

# **HOSPITALIZATION AND THE ORGANIZATION OF DIABETES CARE**

### **11.1 INTRODUCTION**

Patterns of hospital use by the Canterbury ITDM population during the three years 1 January 1984 to 31 December 1986 were identified in Chapter Ten. The inpatient population was heterogeneous in character and in residential location. The aim of this Chapter is, therefore, to examine provider effects on hospital use at the local level. Where there is a hierarchy of services, as in diabetes care, access to care is mediated largely through the referral system. This functions as an organizational filter between supply and demand (Joseph, 1979). In New Zealand, the predominance of hospital and specialist ambulatory diabetes care is provided to individuals on referral from medical intermediaries. Key actors in decision making processes are general practitioners working in the primary care sector and medical specialists in the secondary sector. Patient access to hospital care is largely at their discretion.

Chapters Three and Four discussed the concept of managerialism in health care. The role of doctors as gate-keepers to care and the importance of the organization and interaction of health services in determining patients' access to care were identified. This chapter investigates these ideas in relation to the hospitalization of the Canterbury ITDM population through: first, an examination of the

relationship of the personal and professional characteristics of local general practitioners to variations in diabetes hospitalization; and second, an examination of attendance at available ambulatory specialist diabetes services and the organizational impact of these services on hospital use by the Canterbury ITDM population.

As stated from the outset, this thesis is not a behavioural study of individual patients or their doctors. Rather it is concerned with the aggregate patterns that accrue from decision-making processes. General practitioners are patients' first point of medical contact and are responsible for providing on-going diabetes care. An important function of the general practitioner is to act as an allocator of resources and co-ordinator of care. "The family physician must be responsible to his/her patient for the proper mobilization of available resources to ensure that they are used to the best advantage" (Hunt, 1981, p4). Irrespective of practice setting, general practitioners become the managers of patient care and the gate-keepers to the secondary sector (Somers, 1983; Hurley, 1986).

Clinical and managerial functions of doctors are performed with varying degrees of competence, reflecting their level of skill, abilities and preferences in diabetes management. Rates of hospitalization have been found, in general, to vary greatly between doctors, and for reasons unrelated to medical factors (Wennberg et al, 1982; Rosenblatt and Moscovice, 1984; Dutton, 1986). Wennberg et al (1982) argue that variations in hospitalization stem from professional uncertainty in the diagnosis and treatment of health problems, and from differences in styles of medical practice. Although the overall supply of general practitioners available to an area's population was



not generally related to regional variations in hospitalization for diabetes, doctors as gate-keepers to individual patient care, are undoubtedly a key factor in explaining patterns of hospitalization at the local level.

The second aim of the Chapter is concerned with organizational aspects of the health care system operating in Canterbury in the provision of diabetes care. It is argued that patterns of hospitalization will reflect, in part, the infrastructure of the health care system. Individual use of hospital services is constrained by the organizational arrangement of health services and by the mechanisms through which patient demand is regulated.

As stated in Chapter Nine, Canterbury was chosen as the study area at the microscale because it has a well developed diabetes infrastructure. Integral components of local services are specialist diabetes outpatient clinical and diabetes educational services. Diabetes patient education resources were superimposed on the existing service structure in the late 1970s. Specification of working domains and organizational links between the primary care sector, specialist ambulatory diabetes services and hospital inpatient services were well established by the time of the study period (1 January 1984 to 31 December 1986). It is argued that referral patterns to hospital of the ITDM population will reflect doctor gate-keeping functions to available resources and the organizational interaction that occurs between these health services.

Thus the aim of this chapter is to examine organizational influences on the hospitalization of the Canterbury ITDM population.

What is of concern is whether or not the individuals who ended up in the hospital sector during the study period, did so because of poor access to ambulatory care and inappropriate use of services. Clearly, some patients have a greater propensity to be hospitalized because of their personal characteristics, being elderly or having long-standing diabetes for example. Others may very well benefit from attending specialist diabetes educational programmes but if referral was not forthcoming then access was effectively denied and hospitalization may have been an inevitable outcome.

Before investigating general practitioner characteristics and the use of ambulatory diabetes services in relation to the hospitalization of the Canterbury ITDM population, a brief discussion of methods is given in Section 11.2. More importantly, the actual sources of patient referral to hospital, and their relative importance in contributing to hospital access, are identified in Section 11.3. Although diabetic individuals place considerable demand on hospital care, patterns of referral into hospital have not been researched for this disorder. The aim of this section is therefore to identify and enumerate referral sources of patients to hospital.

## **11.2 METHODS**

The analysis undertaken in this Chapter uses methods described previously in Chapters Nine and Ten. The study population is all insulin-treated diabetic persons identified on the Canterbury Register at the prevalence date 1 January 1984, excluding where appropriate out-migrants from the area during the study period.

Hospital use was traced over the three years to 31 December 1986 for each registrant.

Basic information on patient access to both the Diabetes Education Centre and Diabetes Outpatient Clinic is contained on the ITDM Register. Access was regarded simply as the dichotomy between whether or not an individual had attended either service. This dichotomy between use and non-use is a simple yet effective measure of revealed access.

Dates of first attendance at both services were determined retrospectively from patient casenotes for those individuals who had accessed care during the four years preceding the Register prevalence date of 1 January 1984. Educational programmes were only fully operational from 1980, although the Diabetes Centre was established in 1978. Individuals who had not attended these two services up to 1 January 1984 were followed during the course of the study period to identify whether or not referral was forthcoming after this date.

The source of patient referral to the Diabetes Centre was determined from referral letters and patient casenotes. Data on patient referral to the Diabetes Outpatient Clinic were not obtainable from these sources. Data on referrals to the Diabetes Outpatient Clinic were however obtained from a four month study of patient attendance at this service. Referral pertains only to those individuals who were insulin-treated and who were defined as new attenders, having not attended the Clinic during the 24 months prior to attending the Clinic.

The behaviour of doctors in providing care to their patients reflects both individual doctor characteristics and organizational features of their practices (see Chapter Four). Variations in hospitalization rates have, for example, been found to relate to the age and sex of doctors, their length of training, caseload and casemix, the form and level of remuneration, and whether or not the doctor works in solo or group practice (London Health Planning Consortium, 1981; Wennberg et al, 1982; Rosenblatt and Moscovice, 1984; Dutton, 1986). Personal and professional characteristics affect doctors' beliefs and attitudes towards care and their style of medical care.

Data were extracted from the New Zealand Medical Register and Register of Specialists, and obtained from the Canterbury Hospital Board, to identify practice and personal characteristics of general practitioners caring for persons with ITDM in Canterbury. The names of patients' general practitioners were included in the Diabetes Register database. In particular, data were collected on: (1) sex; (2) year obtaining first medical qualification; (3) year of registration as a medical practitioner in New Zealand; and (4) practice type, whether doctors were in solo practice, two doctor partnerships, group practice (3 or 4 doctors), or large medical centre (5 or more doctors). The year of obtaining first medical qualification was used as a surrogate for age, and year of registration indicated duration of work experience. The hospitalization data reported in this Chapter refers only to those admissions precipitated by conditions directly relating to or concomitant with, diabetes.

### 11.3 PATIENT ENTRY INTO HOSPITAL

In Chapter Ten it was found that 30% of the ITDM population were hospitalized during the three year study period for causes relating directly to, or concomitant with diabetes. These 322 individuals contributed to a total of 652 "diabetes" discharge events. Through what referral source did these individuals access hospital inpatient care?

There are five sources of referral to hospital:

- (1) via an accident and emergency department;
- (2) referral by a patient's general practitioner;
- (3) referral from a specialist in a hospital outpatient department;
- (4) referral from a specialist other than outpatients; and
- (5) transfer from another hospital.

If the general practitioner was identified as the source of patient referral then this implies that the patient had first attended (or contacted) his/her doctor in primary care, and was subsequently admitted via the accident and emergency department (at Christchurch Hospital) after review by hospital staff. The importance of these referral sources will vary depending on the type of admission, that is, whether it was an acute, wait-listed or arranged admission event, and on the cause of admission.

Table 11.1 gives the breakdown of the 652 "diabetes" discharges by referral agent and admission type. Patients largely

**TABLE 11.1**  
**REFERRAL SOURCE AND ADMISSION TYPE**

Referral Source	Admission Type:							
	Acute No.	Acute %	Wait-Listed No.	Wait-Listed %	Arranged No.	Arranged %	Total No.	Total %
Accident-Emergency	91	19.4	-	-	-	-	91	139
General Practitioner	318	67.8	14	9.9	-	-	332	50.9
Outpatient Department	48	10.2	114	80.9	4	9.5	166	25.5
Specialist	4	0.9	11	7.8	18	42.9	33	5.1
Other Hospital	8	1.7	2	1.4	20	47.6	30	4.6
Total	469	100.0	141	100.0	42	100.0	652	100.0

entered hospital from referral from their general practitioner. Of all the admission episodes, 50.9% were on direct referral from patients' doctors. Acute admissions outnumbered wait-listed and arranged admissions 10 to 3 and 11 to 1 respectively. General practitioners accounted for nearly 70% of all acute admission.

There is also a notable referral structure internal to the secondary sector. Referral into inpatient care from outpatient services via hospital based specialists occurred in 25.5% of admissions, the majority of which were wait-listed. These admissions are subsequent to an initial referral of the patient into the secondary sector usually from his/her general practitioner. Specialist referrals other than from outpatient departments and hospital transfers, accounted for small proportions of events. These were typically admissions arranged between the admitting hospital and specialist medical staff and other Board hospitals.

Table 11.1 also illustrates that a significant number of persons with ITDM are hospitalized directly through the Accident and Emergency Department operating at Christchurch Hospital. It is perhaps not surprising that two-thirds of these emergency admissions are for disorders of diabetes control, especially hyperglycaemia (Table 11.2). Heart attacks and strokes also precipitated a number of direct patient entries into hospital. General practitioners are, however, the prime source of referral of people hospitalized for these reasons. General practitioners played an important role in requesting hospital care for all diagnostic categories with the exception of eye and renal diseases.

**TABLE 11.2**  
**CAUSE OF HOSPITALIZATION AND MODE OF REFERRAL**  
**INTO HOSPITAL**

Cause	Source of Referral:					Total
	Accident & Emerg.	G.P.	Out-patient Dept.	Specialist	Other Hospital	
Diabetes Unspecified	9	47	11	4	4	75
Hyperglycaemia & Ketoacidosis	19	66	1	1	3	90
Hypoglycaemia	29	28	3	0	1	61
Renal	5	10	24	0	0	39
Eye	1	3	53	0	2	59
Cardiovascular & Strokes	21	124	26	20	9	200
P.V.D.	5	44	43	7	10	109
Neuropathy	2	10	5	1	1	19
Total	91	332	166	33	30	652



The interaction of hospital outpatient and inpatient services is an important organizational facet particularly in the diagnostic classes involving the long-term chronic complications of diabetes, namely renal, eye and peripheral vascular diseases. Over-representation of diabetic persons in outpatient departments for these disorders is well recognized.

There was no difference in sources of referral by patient sex but there were marked shifts in referral patterns by patient age. Four broad age bands were identified in the population and these are shown in Table 11.3. There were no internal differences between the decades within each age band. The  $\chi^2$ -test for this association was highly significant ( $\chi^2 = 55.52$ ,  $p < 0.001$ ).

Individuals under 20 years of age were prone to direct admission to hospital via accident and emergency services. Children and adolescents are admitted for disorders of control which are largely acute admissions (see Chapter Ten). Few admissions attributed to this age group occurred through hospital outpatient departments in contrast to the adult age groups. This reflects the fact that children and adolescents tend to have been diagnosed for shorter lengths of time than adults, and therefore tend not to manifest diabetes complications which give rise to the demand for specialist interventive services. In addition, individuals under 13 years of age are under the care of paediatric services and tend not to come in contact with other departments.

In contrast, many referrals of younger adults came via hospital outpatient departments (44.6%). Admissions for renal and eye

**TABLE 11.3**  
**PATIENT AGE AT ADMISSION AND SOURCE OF REFERRAL**  
**TO HOSPITAL**

Referral Source	Age Group (Years):									
	0-19		20-39		40-59		60+		Total	
	No	%	No	%	No	%	No	%	No	%
Accident & Emergency	19	37.2	11	10.8	21	11.7	40	12.5	91	13.9
General Practitioner	26	51.0	42	41.6	100	55.5	164	51.2	332	50.9
Outpatient Department	5	9.8	45	44.6	36	20.0	80	25.0	166	25.5
Hospital	1	2.0	3	3.0	23	12.8	36	11.3	63	9.7
Total	51	100.0	101	100.0	180	100.0	320	100.0	652	100.0

**Note:** Referrals from specialists included in hospitals.

disorders were common amongst this group, as well as disorders of diabetes control (Chapter Ten). Such disorders are likely to have brought patients in contact with well established outpatient services.

The two older age bands (40-59 and 60 years of age and over) have similar referral patterns, differing from the two younger groups predominantly through their use of secondary sector services. Referrals from specialists (outside of outpatient services) and other hospitals primarily relate to acute hospital care, or convalescent, for reasons of cardiovascular and peripheral vascular diseases (Table 11.2). Overall, there is a strong interaction between mode of referral into hospital, patient age and cause of admission.

Keeping these factors in mind, referral patterns do vary, although not consistently, by social class (Table 11.4). Given the small numbers involved, it is, however, impractical to investigate possible independent effects of social class standardizing for patient age or cause of admission. Classes V and B identified in Chapter Ten as having high rates of hospital use, have quite different referral pathways into hospital. Many of the admissions from Class V came via Hospital Outpatient specialists, while most admissions of unemployed individuals, social welfare beneficiaries and the like, are referred from their general practitioners.

In conclusion, the referral patterns of persons with ITDM to hospital reflect in the large part the degree of medical urgency, cause of admission, age of patients and patient attendance at existing services. General practitioners are the prime gate-keepers to care, accounting directly for half of all referrals, and contribute via initial

**TABLE 11.4**  
**REFERRAL PATTERNS BY SOCIAL CLASS**  
**(OCCUPATIONAL STATUS) OF PATIENTS**

Occupational Class:												
Referral Source	I,II,IIIN		IIIM,IV		V		A		B		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Accident & Emergency	28	21.9	4	8.2	14	22.2	36	10.9	8	16.7	88	14.3
General Practitioner	59	46.1	28	57.1	25	39.7	179	54.1	28	58.3	319	51.7
Outpatient Department	32	25.0	12	24.5	24	38.1	81	24.5	6	12.5	155	25.1
Specialist	6	4.7	3	6.1	-	-	17	5.1	1	2.1	27	4.4
Other Hospital	3	2.3	2	4.1	-	-	18	5.4	5	10.4	28	4.5
Total	128	100.0	49	100.0	63	100.0	331	100.0	48	100.0	617	100.0

**Notes:**

1. Data missing on 35 cases.
2. See Chapter Nine for definition of social classes - A is Superannuitants and B is Beneficiaries.

referrals (not explicitly identified) to a substantial number of additional admissions arranged through hospital outpatient departments. The role of the general practitioner as a referral agent was only diminished in emergency admissions where patients had direct entry into hospital, or where patients appeared to have well-established chronic diabetes complications and were under specialist outpatient care.

#### **11.4 GENERAL PRACTITIONER CHARACTERISTICS AND HOSPITAL ADMISSION PATTERNS**

This section examines variations in hospitalization rates by socio-demographic and practice characteristics of general practitioners identified in the literature as important predictors of hospital use. The Report of the London Health Planning Consortium (1981) showed, for example, that individuals attending solo practitioners were more likely to be hospitalized than those belonging to group practices for two main reasons: first the lack of continuous availability of general practitioner services meant that primary care was inaccessible to patients during out of office hours; and second, solo practitioners tended to have fewer resources available to them in their practice which would enable them to provide on-going care in the community. They therefore placed greater demand on hospital based facilities. Factors of age and sex of doctors, and length of medical practice will be studied in addition to practice type. These variables are important indicators of doctor behaviour which underlies hospitalization practices.

The section identifies attendance by the ITDM population at general practitioners and examines variations in patterns of hospitalization.

The Canterbury Register of Insulin-Treated Diabetic Persons enables, for the first time, the identification of the ITDM caseload in primary care from a population perspective rather than from doctor recall of patients. At the prevalence date of 1 January 1984, the 1148 ITDM individuals identified on the Register attended a total of 205 general practitioners, (doctors were not ascertained for 12 persons). These doctors form the basis of this analysis.

Basic characteristics of the 205 general practitioners are summarized in Table 11.5. Over 90% of the doctors were male, and half had been registered as medical practitioners for 14 or more years. As stated previously, the time since gaining medical registration is taken as a measure of length of work experience. The time since gaining first medical qualification is more indicative of the doctor's age. The length of time between qualifying and registration as a doctor was on average 2.5 years. About half of general practitioners would be aged between 30 and 45 years.

Similar proportions of doctors practised in the first three practice types, with fewer being involved in large medical centres. While working with other doctors provides professional interaction and sharing of organizational and financial arrangements, virtually all doctors have their own patient lists. Overall, the majority of general practitioners came in contact with few persons with ITDM (Figure

**TABLE 11.5**  
**PERSONAL AND PRACTICE CHARACTERISTICS OF**  
**GENERAL PRACTITIONERS (n = 205)**

Characteristic	Mean	SD	Median	Range
Years since gaining first medical qualification	20.1	12.4	17.0	2-59
Years since registration	17.6	12.8	14.0	1-58
Male (%)	92.2			
Practice Type (%):				
- Solo	28.3			
- Partnership (2)	27.3			
- Group (3 or 4)	30.7			
- Large Centre ( $\geq 5$ )	13.7			
ITDM Case-load (Number of Patients)	5.5	4.3	5.0	1-43

SD is Standard Deviation.

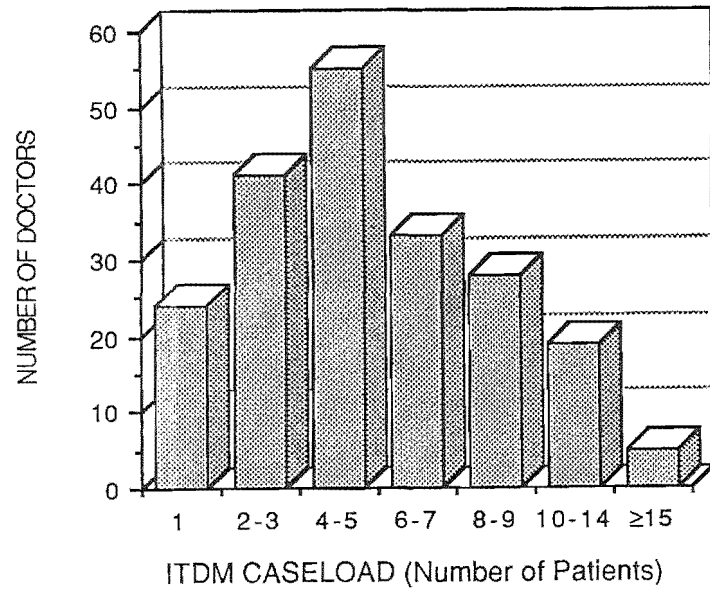
11.1). In total, 58.5% of doctors had ITDM caseloads of five or fewer individuals, and 11.7% saw only one person.

Either through reasons of location, or perception of the quality of care being provided, a large number of patients are concentrated with a small number of doctors. For example, 17 doctors (8.3%) care for more than 10 individuals each. Their combined patient caseload accounts for just over one in every five ITDM individuals (21.9% of the population). The greatest number of patients in the care of any one doctor was 43, all other caseloads were less than 20 persons. This particular doctor was a general practitioner with a specialist interest in diabetes and who was also on the medical staff at the Diabetes Outpatient Clinic.

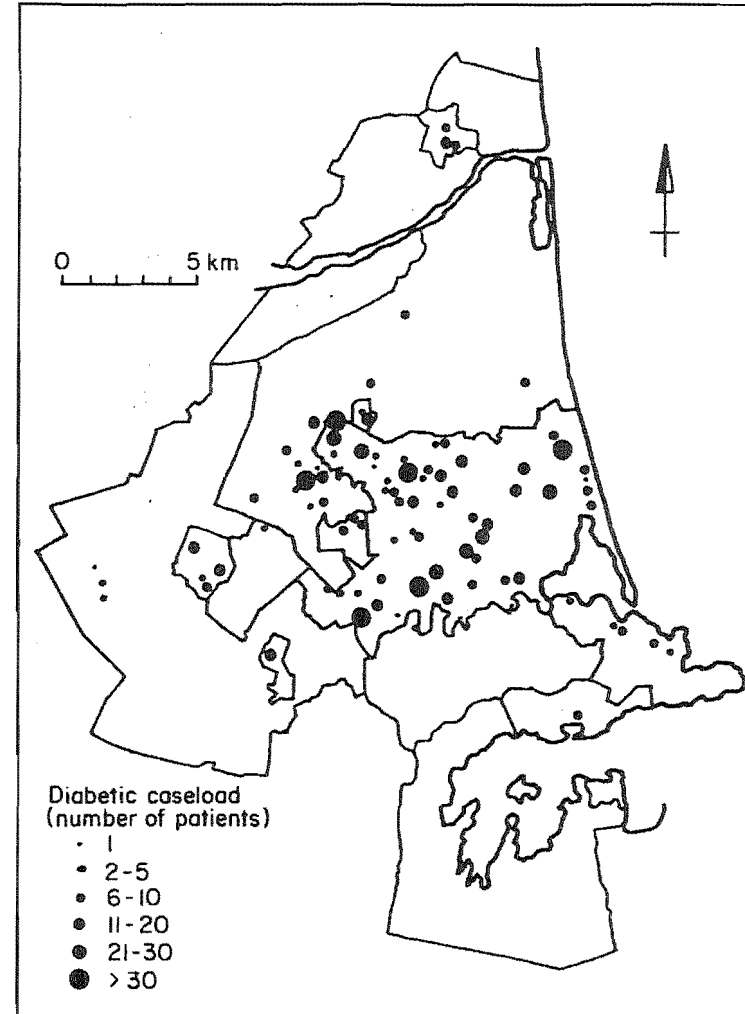
The location of general practices within the urban environment and the concentration of patients at each surgery is shown in Figure 11.2. This represents the combined caseload of the individual doctors working at each practice. The pattern illustrates the point that while the population is spatially disparate (see Figure 9.8) and makes use of a large number of doctors, a significant proportion of patients are concentrated in a relatively small number of group practices and large medical centres. While individuals appear to attend doctors closest to their places of residence, the larger surgeries do draw people from larger catchments.

Varying proportions of the population were cared for by doctors working in each of the four practice types (Table 11.6). The differences between the average number of patients cared for by doctors in the different organizational settings was statistically





**Figure 11.1:** ITDM Caseload in General Practice.



**Figure 11.2:** Location of General Practitioners and ITDM Caseload.

**TABLE 11.6**  
**PRACTICE TYPE AND PATIENT CASE-LOADS**

<b>Practice Type</b>	<b>G.P.s:</b>		<b>ITDM Case-Load (Patients):</b>			
	<b>No</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Mean (SE)</b>	<b>Range</b>
Solo	58	28.3	288	20.1	5.0 (0.4)	1-18
2 Doctor Partnership	56	27.3	266	23.4	4.8 (0.4)	1-15
Group Practice	63	30.7	382	33.6	6.1 (0.5)	1-17
Large Medical Centre	28	13.7	200	17.6	7.1 (1.4)	1-43
Total	205	100.0	1136	100.0	5.5 (0.3)	1-43

Notes: SE is standard error of the mean.  
Doctors not known for 12 persons.

significant (ANOVA,  $p = 0.05$ ). The category for the large medical centres where five or more doctors work in the same practice is biased to a certain extent by the large outlier involving the single caseload of 43 patients. In general, fewer patients attend either solo practitioners or two doctor partnership. However, it should also be noted that certain doctors within each practice type do attract large numbers of patients each.

#### **11.4.1 Hospital Admission Patterns**

Studies examining variations in the rate at which doctors hospitalize patients tend to use doctors as the individual cases and a measure of hospitalization, such as the proportion of patients seen in a given time period that are admitted to hospital as the independent variable (e.g. Rosenblatt and Moscovice, 1984). This approach is not feasible in this analysis because of the small patient caseloads, and therefore the instability in individual doctor admittance rates. The results are, therefore, presented in aggregate form.

As in Chapter Ten, the 59 individuals who moved out of the Canterbury Hospital Board area during the study period are excluded from the analysis. Three doctors were also omitted by removing these individuals. All other patients remain in the database. Data were missing on doctors for 10 of the permanent residents. The following section examines differences in the likelihood that an ITDM individual was hospitalized irrespective of how often they were admitted. This section is then followed by an examination of the relationships between frequency, cause, referral of admission and general practitioner characteristics.

**(a) *Hospitalization of Members of the ITDM Population***

There were 60 patients in the care of female doctors. Overall, 28.3% of these patients were hospitalized during the study period. This compares to a slightly higher rate (29.6%) for patients attending male doctors. There is no significant difference in these rates when the disparity in the number of patients cared for by doctors of each sex is taken into account.

Tables 11.7 and 11.8 present data on the general practitioner characteristics of duration since medically qualifying (age surrogate) and duration since registration (work experience), standardizing for patient age. The three patient age bands were derived from the results of the previous Chapter and are used to control for variations in socio-demographic tendency of patients towards hospitalization.

Overall, the probability that individuals in the care of these doctors were admitted to hospital during the study period ranged from 22.6% to 34.3% by the length of time since doctors qualified and 23.4% to 33.0% since they were registered. In both cases, relatively more patients (attending the younger and less experienced doctors) were hospitalized. This may reflect professional uncertainty and an increased propensity of these doctors to use facilities available in the secondary sector. Patients aged between 40 and 50 years where there is often a degree of uncertainty surrounding diagnosis were prone to admission. The most senior doctors, in terms of age and length of practice, also had a larger proportion of their patients hospitalized on at least one occasion during the study period. Older

**TABLE 11.7**  
**DURATION SINCE DOCTORS BECAME MEDICALLY QUALIFIED**  
**AND PATIENT HOSPITALIZATION**

		Patient Age-Group (Years):											
Duration Since Qual.	No. of Doctors	0-39			40-59			60+			Total		
		Tot.	No Ad	%	Tot.	No Ad	%	Tot.	No Ad	%	Tot.	No Ad	%
5-9*	48	79	16	20.3	50	20	40.0	74	32	43.2	203	68	33.5
10-14	40	77	24	31.2	60	21	35.0	79	29	36.7	216	74	34.3
15-19	25	77	13	16.9	56	10	17.9	63	25	39.7	196	48	24.5
20-24	16	24	6	25.0	29	9	31.0	31	8	25.8	84	23	27.4
25-29	22	39	8	20.5	56	12	21.4	64	28	43.8	159	48	30.2
30-34	20	29	7	24.1	33	5	15.2	44	12	27.3	106	24	22.6
35+	30	21	6	28.6	39	11	28.2	50	18	36.0	110	35	31.8
Total	201	346	80	23.1	323	88	27.2	405	152	37.5	1074	320	29.8

**Notes:**

Data missing of 15 individuals.

3 doctors were excluded with the 59 out-migrants, and data was missing on 1 doctor.

\* The 6 doctors qualifying between 1979 and 1983 (0-4 years) were included with the 42 doctors qualified 5-9 years.  
 Ad = admitted.

**TABLE 11.8**  
**LENGTH OF DOCTOR'S WORK EXPERIENCE**  
**AND PATIENT HOSPITALIZATION**

		Patient Age-Group (Years):											
		0-39			40-59			60+			Total		
Duration Since Reglst.	No. of Doctors	Tot.	No Ad	%	Tot.	No Ad	%	Tot.	No Ad	%	Tot.	No Ad	%
0-4	20	17	7	41.2	22	7	31.8	32	9	28.1	71	23	32.4
5-9	55	123	25	20.3	62	23	37.1	97	42	43.3	282	90	31.9
10-14	30	52	13	25.0	48	15	31.3	58	17	29.3	158	45	28.5
15-19	22	62	16	25.8	55	12	21.8	56	22	39.3	173	50	28.8
20-24	14	18	2	11.1	30	9	30.0	31	11	35.5	79	22	27.8
25-29	18	35	5	14.3	46	10	21.7	50	23	46.0	131	38	29.0
30-34	14	21	6	28.6	26	3	11.5	30	9	30.0	77	18	23.4
35+	28	18	6	33.3	34	9	26.5	37	19	37.3	103	34	33.0
Total	201	346	80	23.1	323	88	27.2	405	152	37.5	1074	320	29.8

**Notes:** Data missing on 15 individuals.  
 3 doctors were excluded with the 59 out-migrants and  
 data was missing on 1 doctor.  
 Ad = admitted.

doctors may find it more expedient to admit patients where resources are available to care for their patients. It is also interesting to note that younger doctors had higher proportions of younger patients in their care, than the older doctors.

A similar investigation reveals differences in the likelihood of patient entry into hospital, between the four organizational practice types (Table 11.9). Although  $\chi^2$ -tests of association were not significant, controlling for patient age differences in doctor caseloads, the 279 individuals in the care of 57 solo practitioners had the lowest propensity to being hospitalized, and these low rates were consistent over the age groups. This is contrary to expectations from general relationships found to exist between practice setting and rates of hospitalization (e.g. London Health Planning Consortium, 1981), although Rosenblatt and Moscovice (1984) also found solo practitioners were less likely to admit patients when the effects of other factors were controlled for.

Familiarity of doctors with the treatment of ITDM may reflect in different rates of hospitalization among their patients. Irrespective of practice setting, and patient characteristics, it was found that individuals attending doctors who had small ITDM caseloads (1-4 patients) were more prone to hospitalization than patients attending doctors with moderate (5-9 patients) or large caseloads (10 or more patients). The respective proportions of patients that were hospitalized at least once during the study period were 38.2%, 26.5% and 29.5% for these three groups of doctors. Doctors caring for few patients might be unfamiliar with the disorder and as a consequence of professional uncertainty, higher proportions

**TABLE 11.9**  
**TYPE OF GENERAL PRACTICE ATTENDED AND LIKELIHOOD**  
**OF INDIVIDUALS WITH ITDM BEING HOSPITALIZED**

Patient Age Group (Years):													
Practice Type	No. of Doctors	Total	0-39		40-59		60+		Total				
			No	%	Total	No	%	Total	No	%	Total	No	%
Solo	57	76	15	19.7	90	25	27.8	113	33	29.2	279	73	26.2
P/ship	55	89	21	23.6	81	26	32.1	81	31	38.3	251	78	31.1
Group	63	116	30	25.9	107	25	23.4	135	60	44.4	358	115	32.1
M/Centre	27	65	14	21.5	46	13	28.3	76	28	36.8	187	55	29.4
Total	202	346	80	23.1	324	89	27.5	405	152	37.5	1075	321	29.9

**Note:** Data missing on 14 individual cases.



of patients are hospitalized. Doctors attracting large ITDM caseloads may care for more patients with health problems which necessitate hospitalization, or doctors are more aware of potential problems and thus have a higher detection rate which reflects in increased referral to hospital.

**(b)      *Admission Rates and General Practitioner Variations***

Results are presented for the 652 admissions attributable to the ITDM population for causes involving, or possibly associated with, diabetes morbid events (see Chapter Ten). Table 11.10 indicates differences in admission patterns of the ITDM population by doctors' duration of work experience in New Zealand as measured by time since gaining registration. The total admission rate (admissions per 10 ITDM persons) for doctors according to time of medical registration again illustrates the parabolic trend in admissions by doctors' length of work experience. Higher admission rates occur amongst patients attending doctors new to general practice, or with long-standing medical careers. Unlike Table 11.8, these include all admission events attributable to the doctor's caseloads.

The importance of doctors as the source of referral of patients into hospital, does, however vary. The admission rate for events referred by general practitioners is given in the final column of Table 11.10. Thus, while doctors gaining registration within 5 years of the Register prevalence date (1 January 1984), or 35 or more years, accounted for relatively high rates of admission among their patients (3.2 and 3.3 admissions per 10 patients respectively), doctors working for 10 to 19 years also emerged as a prime source

**TABLE 11.10**  
**VARIATION IN ADMISSION RATES AND SOURCES OF REFERRAL**  
**BY DURATION OF DOCTOR'S WORK EXPERIENCE**  
**(DURATION SINCE REGISTRATION)**

Source of Admission Referral (% Admissions):							
Duration Since Regist.	Accid. & Emerg.	G.P.	Out-patient Dept.	Spec./ Hospital	Total No. of Admis.	Admis. Per 10 Persons	G.P. Admis. Rate
0-4	20.4	46.9	20.4	12.3	49	6.9	3.2
5-9	10.5	49.1	26.3	14.1	171	6.1	3.0
10-14	15.7	60.7	14.6	9.0	89	5.6	3.4
15-19	11.9	57.4	23.8	6.9	101	5.8	3.3
20-24	13.1	47.8	32.6	6.5	46	5.8	2.8
25-29	17.7	45.6	25.3	11.4	79	6.0	2.7
30-34	8.3	39.6	47.9	4.2	48	6.2	2.5
35+	19.4	50.7	23.9	6.0	67	6.5	3.3
Total	14.0	50.8	25.5	9.7	650	6.0	3.1

**Note:** Data missing on 2 admission events.

of admissions. These doctors contributed to 60.7% and 54.7% of the referrals of their patients to hospital.

One other trend can be discerned. The highest proportions of patients entering hospital via accident and emergency services are again for the two categories of doctors at the ends of the work duration spectrum. In the case of doctors new to general practice (0-4 years work duration) this trend reflects a high admission rate of patients for disorders of control (diabetes unspecified, hyperglycaemia, ketoacidosis and hypoglycaemia) (Table 11.11).

Patients attending solo practitioners maintain low hospital use rates when re-admissions are taken into account (Table 11.12). There was no difference in rates of re-admissions between the four practice types. Solo practitioners directly referred 2.8 admissions per 10 ITDM patients in the three years (49% of referrals). Doctors in both the larger practice organizations, referred higher proportions of their patients, with only a small proportion of admissions coming from specialists working outside of outpatient departments or from other hospitals. This may be a reflection of the range of services and back-up facilities available in large general practices.

There is also a marked difference in the proportion of admissions occurring through accident and emergency services between solo practitioners and the large medical centres, an observation also noted in the study of primary health care in inner London (London Health Planning Consortium, 1981). The patterns of hospitalization of ITDM patients attending solo practitioners are indicative of poor access to primary care during "medical

**TABLE 11.11**  
**CAUSE OF ADMISSION AND DURATION SINCE**  
**GENERAL PRACTITIONER GAINED REGISTRATION**

Duration Since Regist.	Disorders of Control:			Associated Long-Term Diabetes Complications:		
	Number of Admissions	% of Total	Admission Rate	Number of Admissions	% of Total	Admission Rate
0-4	22	44.9	3.1	27	55.1	3.8
5-9	43	25.2	1.5	128	74.8	4.6
10-14	46	51.7	2.9	43	48.3	2.7
15-19	37	36.6	2.1	64	63.4	3.7
20-24	16	34.8	2.0	30	65.2	3.8
25-29	23	29.1	1.7	56	70.9	4.3
30-34	19	39.6	2.5	29	60.4	3.7
35+	19	28.4	1.8	48	71.6	4.7
Total	225	34.6	2.1	425	65.4	3.9

**TABLE 11.12**  
**PRACTICE TYPE, REFERRAL SOURCE AND**  
**HOSPITAL ADMISSION RATES**

Source of Admission Referral (% Admission):							
Practice	Accid. & Emerg.	G.P.	Out- patient Dept.	Spec./ Hospital	Total No. of Admis.	Admis. Per 10 Persons	G.P. Admis. Rate
Solo	15.9	49.0	23.6	11.5	157	5.6	2.8
P/ship	14.1	44.9	27.5	13.5	156	6.2	2.8
Group	14.2	53.8	24.4	7.6	225	6.2	3.4
M/Centre	10.6	55.8	27.4	6.2	113	6.0	3.4
Total	14.0	50.8	25.5	9.7	651	60.3	30.7

emergencies", but whether or not low admission rates overall reflect a good understanding between patients and their doctors, or poor detection of health problems, requires further investigation.

## **11.5 USE OF DIABETES AMBULATORY SERVICES AND HOSPITALIZATION**

An important aspect of the organization of diabetes care in New Zealand is the provision of specialist diabetes educational and clinical services. Together with general practice, these services provide ambulatory health care to ITDM persons in the community. A prime function of both the Christchurch Diabetes Centre and Diabetes Outpatient Clinic is prevention or minimization of hospitalization of individuals with diabetes.

Local diabetes specialists advocate patient attendance at the Diabetes Centre at least once. This service functions essentially as an educational intervention resource centre. Patient education, dietary counselling and instruction on self-management techniques are, for example, provided in programmes spanning one or two months (Hopman, 1988). Patient follow-up is on a short-term basis, usually six months. The service does not involve on-going care which is seen as the responsibility of the general practitioner. Patients may be referred to the Centre at any time, but the Centre functions as an ancillary service with patients remaining in the care of their doctors.

While the Diabetes Outpatient Clinic provides specialist care for acute referrals one of its prime functions is providing routine specialist review of diabetic patients. This allows for biochemical and

physical investigations not otherwise possible or practical in the primary care sector. Thus, attendance on this service is also desirable for reasons of prevention and early detection of diabetic complications and problems, as well as for specialist intervention during medical crises.

The aim of this section is to report patient access to these services, and to examine the relationship of these service patterns to hospital admission.

#### **11.5.1 Access to Diabetes Services**

Because children 12 years and younger are under the care of the Paediatric Department of Christchurch Hospital and do not use the Diabetes Outpatient Clinic, and place informal demand only on the Diabetes Centre, these children are excluded from the analysis (as at 1 January 1984, 39 individuals were aged under 13 years). At the Register prevalence date of 1 January 1984 47.5% of the ITDM population had attended the Diabetes Centre, and 49.1% the Diabetes Outpatient Clinic. During the study period additional use was made of these facilities with a total of 62.9% of the ITDM population accessing educational facilities by 31 December 1986, and 54.8% specialist outpatient services. The majority of new attendance during the study period occurred in 1984, with very few of the Register population newly accessing services in 1985 and 1986.

The ITDM population can be divided into four service-mix groups:

- (1) Those individuals attending neither service, i.e. non-users;
- (2) Those using outpatient clinical services only;
- (3) Those attending educational programmes only; and
- (4) Joint-users who have accessed both services.

The characteristics of these population subgroups are given in Table 11.13. There is marked disparity in access by both patient age and duration of diabetes as at 1 January 1984 (an ANOVA analysis was significant at  $p < 0.001$  for both these factors). Only 22.4% of the ITDM population were in the sole care of their general practitioners. These persons were older and had had diabetes for a longer period of time than the greater proportion of people (40.1%) who had attended both the Diabetes Centre and Diabetes Outpatient Clinic.

It is the general practitioner who is the prime gate-keeper to ancillary care (Table 11.14). Of the 698 individuals attending education-intervention based programmes at the Diabetes Centre (groups 3 and 4), 31.2% ( $n = 128$ ) were also referred through the Diabetes Outpatient Department. Not unexpectedly, there is a clear and strong interaction between the two Canterbury Hospital Board run diabetes specialist services. If an individual gains access to one service, then there is a high probability they will be referred to the other by hospital based specialists.

Although there was no overall association between the use of diabetes services by patients under the care of general practitioners in different practice setting ( $\chi^2$ -test n.s.) (Table 11.15), specific



**TABLE 11.13**  
**CHARACTERISTICS OF INDIVIDUALS WITH ITDM USING**  
**DIFFERENT DIABETES SERVICES MIXES**

Population Subgroup	Individuals		Age			Duration of Diabetes		
	No	%	Mean(SE)	Median	Range	Mean(SE)	Median	Range
Non-users	248	22.4	56.7(1.2)	59	13-93	16.4(0.7)	14.5	1-58
OPD Clinical Services Only	163	14.7	52.3(1.4)	56	14-88	15.6(0.8)	13.0	1-48
Education Only	253	22.8	50.4(1.2)	53	13-85	13.0(0.7)	11.0	1-50
Both Specialist Services	445	40.1	45.7(0.9)	47	13-84	13.8(0.5)	12.0	1-57

**Note:** Excludes 39 individuals aged  $\leq 12$  years as at 1 January 1984. OPD = Outpatient Department.

**TABLE 11.14**  
**REFERRAL SOURCES TO DIABETES SPECIALIST SERVICES**  
**(PERCENTAGE OF ATTENDERS)**

	Diabetes Centre	Diabetes Outpatient Clinic
General Practitioner	57.3	66.7
Diabetes Outpatient Clinic	31.2	-
Diabetes Centre	-	28.5
Hospital Ward	8.8	-
Specialist	2.0	4.8
Paediatric Department	0.7	-
Total	100.0	100.0

**TABLE 11.15**  
**PATIENT USE OF DIABETES SPECIALIST SERVICE BY TYPE OF**  
**GENERAL PRACTICE ATTENDED**  
**(PERCENTAGE OF EACH POPULATION SUBGROUP)**

<b>Population Subgroup</b>	<b>Practice Type:</b>				<b>Total</b>
	<b>Solo</b>	<b>P/ship</b>	<b>Group</b>	<b>M/Centre</b>	
Non-Users	18.6	20.8	21.7	26.3	21.5
OPD Clinical Services Only	17.2	13.3	15.2	12.9	14.9
Education Only	21.5	22.8	22.5	26.8	23.1
Both Specialist Services	42.7	43.1	40.6	34.0	40.5
Total	100.0	100.0	100.0	100.0	100.0

**Note:** 12 cases missing, all being non-users.  
 OPD = Outpatient Department.

differences emerged, however, between solo practice and large medical centres. One in four ITDM individuals attending large medical centres had not used either specialist diabetes service, compared to one in five for people in the care of solo practitioners. Furthermore, individuals attending doctors in the large organizational primary care establishments were less likely to be multiple users of facilities, placing more demand on diabetes patient educational services than on those offered by specialists. This reflects the availability of resources within each practice type, the confidence of doctors in providing care for their patients and their perception of diabetes specialist services.

Doctors most recently registered (within five years of the start of the study period) had a higher proportion of their patients using ancillary diabetes services (Table 11.16). Two thirds of their patients ( $n = 71$ ) had attended either the Diabetes Outpatients Clinic or the Diabetes Centre, and nearly half were joint users. Since local diabetes specialists have emphasized and publicized the function of both ambulatory services, especially to young medical staff, this pattern probably reflects increased awareness of these services by these doctors. Professional uncertainty, with limited work experience, no doubt combines with this increased service awareness, giving rise to the high propensity of patient referral by newly registered general practitioners. Higher proportions of patients were retained within primary care by doctors who had increased durations of medical practice.

**TABLE 11.16**  
**DURATION SINCE DOCTOR GAINED MEDICAL REGISTRATION**  
**AND PROPORTION OF PATIENTS USING SPECIALIST**  
**DIABETES SERVICES**

<b>Time Since Registration</b>	<b>Population Subgroup:</b>				<b>No. of Persons</b>
	<b>Non- Users</b>	<b>OPD Clinical Services Only</b>	<b>Education Only</b>	<b>Both Specialist Services</b>	
0-4	15.5	16.9	19.7	47.9	71
5-9	20.8	11.9	22.2	45.1	293
10-14	17.9	16.0	24.1	42.0	162
15-19	24.3	18.1	27.7	29.9	177
20-24	23.1	16.7	21.8	38.5	78
25-29	24.4	10.7	24.4	40.5	131
30-34	25.6	18.0	19.2	37.2	78
35+	19.8	16.0	20.8	42.4	106
Total	21.5	14.9	23.1	40.5	1096

**Note:** Data missing on 13 cases (most of whom were non-users).

### **11.5.2 Admission to Hospital and Attendance at Diabetes Specialist Services**

Do these service-user groups have different propensities for hospital admission? Expected outcomes in terms of entry into the hospital sector are complex since the individuals remaining within primary care may either have good health, and therefore, not demand ancilliary diabetes care, or alternatively they may benefit from attendance but access to care has been inhibited through organizational or individual barriers. In the first situation, hospital use would be expected to be low and high in the latter case. In addition, both educational and clinical outpatient services provide preventive care, but they also provide a remedial based care for individuals already exhibiting acute or chronic complications of diabetes.

Thus, sectors within each group of ITDM patients using specialist diabetes services may have quite different hospital use patterns. As a consequence of varying demand, through population heterogeneity, few differences may be observed overall between the four service users.

This situation is evidenced in Tables 11.17 to 11.20. These tables relate to the proportion of individuals in each of the four service user groups admitted to hospital, irrespective of how often, during the three year study period. Patient age and duration of diabetes were determined at 1 January 1984. Individuals were categorized as having attended or not attended diabetes services prior to entry into hospital. Tables 11.17 and 11.19 are simple

dichotomies between use and non-use of either the Diabetes Centre or Diabetes Outpatient Clinic and Tables 11.18 and 11.20 break the population down into the 4 service-user groups. Small discrepancies occur in rates reported in different tables through missing data cases.

Slightly fewer attenders were admitted than non-users of specialist diabetes services (Table 11.17). These differences were not statistically significant ( $\chi^2$ -test) for either the Diabetes Centre or Diabetes Outpatient Clinic. Differences in hospital use did occur by the age of persons in the ITDM population. For example, the very elderly users (age  $\geq 70$  years) in both cases, were more prone to admission. These individuals may have been identified as high health risk patients, and were, thus, referred to specialist services by their doctors. They were subsequently hospitalized after attending the Diabetes Centre or the Diabetes Outpatient Clinic.

It was only in this age group (age  $\geq 70$  years) that more patients were non-attenders than accessed specialist services (Table 11.17). Requirement for specialist diabetes care is perhaps also evidenced by the fact that more of the individuals who used only outpatient clinical services were admitted (Table 11.18). This was consistent by patient age.

Tables 11.19 and 11.20 reveal differences in hospital admissions, controlling for differences in the duration of diabetes among the ITDM population. This factor impacts on both attendance patterns at specialist services and the likelihood of patients having diabetes complications. Nearly 75% of individuals with recently diagnosed diabetes (duration 0-4 years) had, for example, attended

**TABLE 11.17**

**PROPORTION OF ITDM INDIVIDUALS ADMITTED TO HOSPITAL**

**BY AGE (AS AT 1 JANUARY 1984) AND ATTENDANCE**

**ON DIABETES AMBULATORY SERVICES**

<b>Patient Age-Group</b>	<b>Patient Education Services:</b>				<b>Outpatient Clinical Services:</b>			
	<b>Non-Attend-Total</b>	<b>ers %</b>	<b>Attend-Total</b>	<b>ers %</b>	<b>Non-Attend-Total</b>	<b>ers %</b>	<b>Attend-Total</b>	<b>ers %</b>
	<b>No</b>	<b>Ad.</b>	<b>No</b>	<b>Ad.</b>	<b>No</b>	<b>Ad.</b>	<b>No</b>	<b>Ad.</b>
13-29	43	25.6	145	25.5	67	28.4	121	24.0
30-39	44	22.7	78	14.1	53	13.2	69	20.3
40-49	44	29.5	88	27.3	54	22.2	78	32.1
50-59	76	26.3	118	28.0	90	30.0	104	25.0
60-69	87	31.0	133	31.6	105	33.3	115	29.6
70+	102	42.2	86	46.5	110	40.9	78	48.7
Total	396	31.3	648	28.9	479	30.3	565	29.4

**Notes:** Cases total 1044 individuals; excludes individuals under 13 years of age as at 1 January 1984 (n=36, 3 were excluded as out-migrants); missing age data for 9 cases. Ad = admitted.



**TABLE 11.18**  
**ADMISSION TO HOSPITAL BY SERVICE-USER GROUPS**  
**AND PATIENT AGE**

Population Subgroup	Patient Age-Group (Years):							
	13-39		40-59		60+		Total	
	Total No	% Ad.	Total No	% Ad.	Total No	% Ad.	Total No	% Ad.
Non-Users	50	20.0	67	25.4	119	36.1	236	29.7
OPD Clinical Services Only	37	29.7	53	30.2	70	38.6	160	33.8
Education Only	70	22.9	77	28.6	96	38.5	243	30.9
Both Services	153	20.9	129	27.1	123	36.6	405	27.7
Total	310	22.2	326	27.6	408	37.3	1044	29.8

**Notes:** Excludes 36 persons aged  $\leq 12$  years as at 1 January 1984. Age data missing for 9 cases.  
Ad = admitted.

**TABLE 11.19**  
**PROPORTION OF ITDM INDIVIDUALS ADMITTED TO HOSPITAL**  
**BY DURATION OF DIABETES (AS AT 1 JANUARY 1984) AND**  
**USE OF DIABETES AMBULATORY SERVICES**

Duration of Diabetes	Patient Education Services:				Outpatient Clinical Services:			
	Non-Attendern		Attendern		Non-Attendern		Attendern	
	Total No	% Ad.	Total No	% Ad.	Total No	% Ad.	Total No	% Ad.
0-4	42	42.9	122	19.7	84	25.0	80	26.2
5-14	155	25.8	270	24.4	184	27.2	241	23.2
15-24	113	31.9	166	31.9	122	27.1	157	35.7
25+	81	35.8	87	49.4	84	47.6	84	38.0
Total	391	31.5	645	28.8	474	30.4	562	29.4

**Note:** 17 missing cases.  
Ad = admitted.

**TABLE 11.20**  
**ADMISSION TO HOSPITAL BY SERVICE-USER GROUPS AND**  
**DURATION OF DIABETES**

Population Subgroup	Duration of Diabetes (Years):									
	0-4		5-14		15-24		25+		Total	
	Tot. No	% Ad.	Tot. No	% Ad.	Tot. No	% Ad.	Tot. No	% Ad.	Tot. No	% Ad.
Non-Users	21	38.1	92	27.2	69	27.5	50	36.0	232	30.2
OPD Clinical Services Only	21	47.6	63	23.8	44	38.6	31	35.5	159	33.3
Education Only	63	20.6	92	27.2	53	26.4	34	64.7	242	30.6
Both Services	59	18.6	178	23.0	113	34.5	53	39.6	403	27.8
Total	164	25.6	425	24.9	279	31.9	168	42.9	1036	29.8

**Note:** 17 missing cases.  
Ad = admitted.

educational services at the Diabetes Centre. It is in this group that there are noticeable and statistically significant differences in entry into hospital ( $\chi^2$ -value = 8.816,  $p < 0.01$ ). There is a two-fold difference in the proportion of individuals admitted between attenders and non-attenders (Table 11.19).

Those recently diagnosed individuals attending the Diabetes Outpatient Clinic may be doing so because of problems with diabetes control, and hence their demand for hospital care (Table 11.19). In contrast, following a policy of annual patient review, those individuals with duration of diabetes 5 to 14 years, may use these clinical services more for routine preventive care. Their probability of hospitalization as a group is relatively low, and independent of whether or not they use educational services as well (Table 11.20).

While patient education may act towards improving probability of hospitalization in newly diagnosed individuals, those with long-standing diabetes place demand on services for quite different reasons. Nearly half of the 87 individuals who had attended the Diabetes Centre and who had had diabetes for at least 25 years were hospitalized during the course of the study period (Table 11.19) and two thirds of the 34 persons making use only of the Centre were admitted (Table 11.20). Many of the patients with long-standing diabetes are referred to the Diabetes Centre for educational revision and updating of diabetes management techniques. Many persons are at high risk to hospitalization through their poor management skills and the occurrence of long-term diabetes complications.

Some of these trends are reinforced when the causes of admission to hospital are identified for each population subgroup (Table 11.21). While diabetes patient education aims to minimize acute problems of diabetes control, the Diabetes Centre will have attracted individuals prone to admission from disorders of control. Thus, in the short term, admission rates (number of admissions for each diagnostic category per 10 persons in each service-user group) were higher for people attending education services compared to those not. The admission rate for hypoglycaemia in this group may also reflect the pursuit of tight metabolic control with increased risk to hypoglycaemia.

Differences are also noticeable in the frequency of admissions for renal and eye diseases by the four ITDM population subgroups. Those not using specialist services have low admission rates, and contributed to only 10% of admissions for these two disorders. Those using diabetes outpatient clinical services only by comparison had high per capita rates of hospitalization for renal disease and similar per capita rates of admission for eye disorders to those using educational facilities. Individuals with these two readily identifiable complications of diabetes, thus appear to be referred into the secondary sector where a substantial part of their overall care is provided.

In contrast, slightly higher rates of admission for peripheral vascular disease (PVD) occurred in people remaining within the community than in those accessing both services. While PVD is well recognized as a complication of diabetes, service provision is not as organizationally distinct as for either renal or eye disorders. Thus,

**TABLE 11.21**  
**TRIENNIAL ADMISSION RATES (NUMBER OF ADMISSIONS**  
**PER 10 PERSONS) BY SERVICE USER GROUP AND**  
**CAUSE OF ADMISSION**

Cause	Service-User Group:			
	Non-Users (n=243)	OP Clinical Services Only (n=160)	Education Services Only (n=245)	Both Specialist Services (n=405)
Diabetes Unspecified, Hyperglycaemia and Ketoacidosis	1.5	1.1	1.8	1.7
Hypoglycaemia	0.5	0.3	0.4	0.9
Renal	0.2	1.3	0.1	0.3
Eye	0.2	0.6	0.7	0.7
Cardiovascular and Stroke	1.6	1.7	2.1	2.0
P.V.D.	1.2	1.0	1.1	0.9
Neuropathic	0.1	0.1	0.2	0.1
Total	5.3	6.1	6.4	6.6

similar rates among the service-user groups might be expected in the short term.

Groups of ITDM individuals attending the Diabetes Centre either in association with or without Diabetes Outpatient Clinic, were prone to hospitalization through cardiovascular disease more so than the other two groups. This may very well reflect the overall demographic characteristics of the population subgroups. There was for example a statistically significant difference in the age of patients at time of admission to hospital for cardiovascular (including strokes) problems (ANOVA,  $p < 0.001$ ). The mean age of patients admitted from within the community (non-users) was 68.6 years, for those using diabetes outpatient services only 58.2 years, and 61.4 years for individuals attending the Diabetes Centre only and for the multi-user group. The age group at risk to heart attacks are those in their fifties and sixties. Of these individuals in the ITDM population, 61% had attended educational facilities, 22% had attended neither the Diabetes Centre nor Diabetes Outpatient Clinic, and 17% were sole users of the Clinic. This age differentiation may be reflected in the observed per capita admission rates.

## **11.6 SUMMARY AND CONCLUSIONS**

Heterogeneity in the provision of diabetes care and use of services by insulin-treated diabetic persons has been observed. Hospital admission patterns reflect the interaction of patients with the organizational environment in which they obtain diabetes care. The ITDM population is partitioned by the structure of the local health system in a variety of ways for a variety of reasons.

Entry of patients to the secondary sector, both in terms of admission to hospital and access to specialist diabetes ambulatory services, is for the most part at the discretion of the general practitioner. The ITDM population obtains care from a large number of doctors who differ in their personal and practice characteristics. Over half of the doctors have five or fewer ITDM patients in their practice. However, a small proportion of doctors have attracted relatively large diabetic case-loads.

The general practitioner acts as the patient's gate-keeper to care. Over half of all admissions were on direct referral from primary care doctors. It is these doctors who are responsible for identifying patients' needs for care and making arrangements necessary to see that these needs are met. The majority of referrals to the two specialist ambulatory diabetes services are via general practitioners. An additional 25% of admissions were through patient attendance of hospital outpatient departments. As in the macro-level analysis, specialists have been found to play an important role in determining rates of diabetes related hospitalization at the local level.

Variations occurred in hospital use both in terms of the likelihood of individuals becoming hospital inpatients (irrespective of frequency of admission) and total per capita admission rates, for different general practitioner characteristics. Differences reflected several facets of general practice, one of which was the age of doctors and their duration of work experience. Both recently registered doctors, and thus, typically the young doctors, and those doctors with the longest careers, the older doctors, had high admission rates



among their patients. Greater proportions of their patients were also admitted through accident and emergency services. Overall, differences in admission patterns may reflect the confidence and familiarity of doctors in treating persons with ITDM as well as their awareness of ancilliary services and propensity to use these in the care of their patients.

Admission patterns also differed between the four practice settings examined. Lowest rates of hospitalization were observed in patients attending solo practitioners. The reasons for this are unclear. Some 28% of doctors in Canterbury are solo practitioners, and jointly they care for 20% of the ITDM population. Admissions to hospital were relatively low for patients in their care even when the key individual determinant of patient age was controlled for. However, a greater proportion of admissions occurred via the Accident and Emergency Department at Christchurch Hospital. It may be that solo practitioners provide greater personal contact and have closer doctor-patient relationships which reflect in reduced hospitalization. Alternatively, they may detect fewer problems which are diagnosed by doctors in group practices. It also appears that patients experience difficulties in accessing care during out of surgery hours when emergencies arise.

While admission rates do not necessarily differ between people attending the large medical centres (with five or more doctors) and other types of general practice, referral patterns or conduits to care do. For example, these general practitioners contributed to the highest proportion of patient referrals into hospital by practice type. In addition, only 10.6% of admissions to

hospital by patients seeing doctors belonging to these large medical establishments, occurred through accident and emergency services, and fewer admissions through hospital transfers or specialist referrals from outside of outpatient departments. Furthermore, a higher percentage of these patients (26.3%) used neither of the two specialist diabetes ambulatory services, and only slightly over 30% had attended both. The referral decisions made by doctors in these practices, in terms of requesting additional care and the use of services made by their patients, will be influenced by the availability of resources and back-up support within the practice.

A relatively large sector of the ITDM population, one in every five individuals, remained within the community accessing neither specialist diabetes service. Attendance on diabetes patient education services and diabetes outpatient clinical services, and the impact on hospital admission rates is complex. Overall, there is no difference in the likelihood of an individual being admitted to hospital whether they had or had not attended these facilities. This largely reflects the dual function of both services in providing treatment for existing problems and acute care, and intervention for reasons of prevention and health maintenance.

While diabetes education services have become established into the system in recent years, they have also captured a larger proportion of the population and therefore significantly more of the people at risk to hospitalization. Initial differences in hospitalization between attenders and non-attenders on diabetes education reported previously (Scott et al, 1985) no doubt reflected a selective case load of well motivated patients from doctors who favoured increased

patient awareness and involvement in the management of their disorder. A greater spectrum of patients are now referred, and different demands are placed on services.

The results presented here should not be interpreted that diabetes patient education, or clinical ambulatory services, are of little value in preventing hospital admission of persons with ITDM. Rather, on a population basis, differences within the four population subgroups obscure differences between them. For example, the group of patients attending Diabetes Outpatient Clinic only, appears to be over-represented by individuals suffering from the chronic microvascular complications of renal and eye diseases. These individuals are prone to hospital admission which is reflected in the admission rates for this group.

The reasons for referral of some individuals to the Diabetes Centre, or Clinic, may be associated with high risk of hospitalization. For example, admissions of elderly people using educational facilities are high as are those for people with long-standing diabetes. While the intention is remedial, to improve the health outcomes of these individuals, intervention may not substantially diminish their admission to hospital in the short term. In contrast, however, rates of hospitalization were notably lower in those people who were more recently diagnosed (0-4 years duration of diabetes) and who had attended educational programmes than those who had not. A confounding factor to this is disparity in age of patients referred.

Overall, benefits expected to accrue from patient education in terms of reduced rates of hospitalization were not apparent.

Diminished requirements for hospital resources may, however, be only evident in the long term as newly diagnosed individuals and those not suffering already from diabetes complications are followed over their life-span.

Processes of referral and patterns of health services used by this population are complex. The organizational structure, particularly the interaction between primary and secondary services, is an important facet of the local diabetes health care system. General practitioners clearly play a fundamental role in determining patient outcomes in terms of both admissions to hospital and access to specialist diabetes services.

## CHAPTER TWELVE

### CONCLUSIONS

#### 12.1 INTRODUCTION

*Diabetes mellitus* is a major health problem in New Zealand. Through its complications, it leads to increased levels of morbidity and premature death. This thesis shows considerable demand is placed on hospital services by the diabetic population. The provision and organization of health care resources are key determinants of rates of diabetes related hospitalization. This thesis has identified the existence of Roemer's Law of supply induced demand for hospital care for diabetes, and has reported the influence, at the local level, of the referral system and organization of diabetes services on hospital admission of insulin-treated diabetic persons.

This chapter provides a summary of the main arguments and findings of the research, and discusses the significance of the results and their implications for health care policy.

#### 12.2 SUMMARY: DIABETES MELLITUS AND HOSPITAL USE

Diabetes affects in the order of 100,000 New Zealanders (Neal and Beaven, 1988). The health consequences are severe. Diabetes, as a chronic health disorder, poses a challenge to modern health care systems, which to date, have not coped well meeting the health care

needs of affected persons. Diabetic individuals are at risk from the acute crises of hyperglycaemia, diabetic ketoacidosis and hypoglycaemia, but undoubtedly, the major costs to health are from the chronic complications of heart disease, stroke, lower limb amputation, renal failure, visual impairment and blindness. The quality of diabetes control remains poor and health outcomes less than satisfactory.

This thesis argues that the impact of the organization of diabetes care on patterns of hospital use is best understood by locating diabetes services within the health care system as a whole, and by examining forces operating within and outside the health sector. The philosophical nature of diabetes care, and the allocation and organization of resources to diabetes, reflect both the dominance of the medical model in the health system and recent shifts in the social meaning of health and the functions of medicine.

The medical model, based on the scientific paradigm of medicine, led to the adoption of a mechanistic or engineering approach to human health. In the context of wider societal forces, the medical model promoted technological and 'scientific' solutions to health problems with a resultant focus on treatment and cure. Medical resources, including the medical work-force, became highly specialized and spatially concentrated. Care was institutionalized and a doctrine of individualism promoted. At the same time, the social causation of ill-health was largely ignored and collective responsibilities passed over. In recent years, however, the

increasing burden of chronic health problems has forced attention to the effect of people's lifestyles on their physical health status.

The aetiology and physio-pathogenesis of diabetes demands a health care approach founded on a better understanding of the determinants of health than traditionally offered through the medical model. Internationally the philosophy of diabetes care is largely one of patient education which embodies both principles of behavioural modification and patient self management.

Diabetes educational facilities were, however, superimposed on existent services without full comprehension of diabetes epidemiology or the organization of care. Care is fragmented, and services have developed on an ad hoc basis. Additionally, moves towards community care, via patient education, were undertaken within the existing rigid structural framework of the health care system.

Orthodox medical interests in diabetes, such as clinical practice, aspects of pharmacology, or biological research, have not been eroded, and while benefits have accrued to patients from service re-orientation, the development of diabetes patient education did serve to reinforce dominant medical interests. The introduction of diabetes patient education into diabetes care attests to a broadening of the understanding of health, but at the same time, it has facilitated medical imperialism and the co-optation of lifestyle politics into modern diabetes management practices. For example,

patient access to resources is still dependent on doctors' prescription and referral; patient education is essentially therapeutically oriented; it is based on individualism with increased emphasis on self-management and individual responsibility, and with overtones towards victim-blaming when diabetes therapy fails; and the power of authority over programme content, the definition of diabetes management strategies, and what constitutes socially legitimate patient behaviour, remain almost totally in the hands of the medical profession.

Moves toward the de-institutionalization of diabetes care, not dissimilar to experiences in mental health care (Dear and Wolch, 1987), have occurred without re-allocation of resources and without consideration of appropriate organizational forms of care in the long term. Hospital based services continue to attract substantial rates of use for diabetes. Through the structure of hospital care in New Zealand, diabetic patients continue to come under the care of many different specialties. Patterns of hospitalization for diabetes reflect systemic factors in the provision of health care resources and hospital admission practices.

Over the last 25 years, levels of hospital admission (discharge) for diabetes increased both in absolute terms and on a per capita basis. While increased prevalence of diabetes in the community no doubt contributed in part to the rise from 75 hospital discharges (with diabetes as the principal cause of hospitalization) per 100,000 persons in the early 1960s to 100 discharges per 100,000 persons in



the 1980s, the explanation for this increase is found also in general patterns of hospital use. Trends over time in diabetes admissions and length of hospital stay parallel overall changes in hospital use in New Zealand for all causes. Additionally, different trends in diabetes hospitalization occurred in different sectors of the population. These patterns cannot simply be explained by changes in diabetes prevalence.

Considerable geographic variation occurs between regional hospital board populations in their rates of diabetes hospitalization. During the eight year study period 1979 to 1986, mean annual area rates of discharges for diabetes (as the principal cause of admission) per capita ranged from 7.0 to 24.0 discharges per 10,000 residents. A two-three fold variation was also observed in annual rates of per capita days stay. Areas with noticeably high rates of hospitalization for diabetes were the smaller rural boards which typically had high per capita availability of hospital beds. In contrast, the large urban boards with relatively low hospital bed supplies, had lower rates of hospital use for diabetes. Annual variations in hospitalization rates, and levels of unexplained variability in the regression models presented in Chapter Eight, were commensurate with a high degree of randomness in area rates of diabetes hospitalization.

Overall, rates of hospital use for diabetes appeared to have more to do with the availability of medical resources to area populations than to their socio-demographic characteristics. The most important predictors of rates of diabetes hospitalization, both in

terms of discharges and patient days stay, were an area's bed supply, level of education and supply of hospital based specialists. Partitioning the variance in rates of hospital use between socio-demographic and health system factors, revealed that diabetes hospital use rates were sensitive to the supply of medical resources, especially hospital bed supply, even when the socio-demographic characteristics of the area populations were controlled for.

Thus, the positive relationships observed between per capita rates of diabetes hospitalization and area hospital bed supply, standardizing for population differences, show that Roemer's Law operates in diabetes hospitalization in New Zealand.

Overall, very few of the population characteristics studied related directly, or indirectly, to area variations in diabetes hospitalization. The best socio-demographic predictors contributed little independent effect in explaining the variance in hospital use rates when medical resources were controlled for. As indicated above, the best socio-demographic predictor of hospital use was the educational status of an area's population. However, the role of this variable, given its collinearity with hospital bed supply, was uncertain. It is postulated that educational status is a reflection of the degree to which areas are urbanized. A simple locational interaction may, thus, occur between bed supply and educational status, with the latter acting as a locational surrogate for the former. However, the social effect of education in health care behaviour may be valid at this level of analysis and the unique contribution from this

variable to variations in diabetes hospitalization cannot be overlooked. Age and ethnicity, both conceptually important variables, lacked explanatory power at the macro-level and this may have been due to scale effects.

The area analysis of diabetes hospitalization not only revealed the importance of hospital bed supply in influencing rates of hospital use for diabetes but also the availability of the specialist medical work-force. The more specialists available to provide hospital based diabetes care to an area's population, *ceteris paribus*, the greater are the rates of hospitalization. The importance of the medical profession in influencing patient use of hospital inpatient resources was also revealed at the local level.

The macrostructure of the health care system plays an important role in determining aggregate utilization patterns through both the allocation of resources to diabetes and by conditioning the beliefs and values surrounding health and health care. Hospital use is also a function of the organizational structure and operation of the local health care delivery system. Problems arise through the fragmentation of health services used in diabetes care, the dependence on a referral system which may or may not lead to appropriate access to care, and practical difficulties and inadequacies in the provision of both diabetes clinical and educational care. Persons with diabetes will only benefit from the potential advantages of diabetes education if they have access to appropriate services, and

if they and providers of care adhere to the same philosophy and support this via their diabetes management practices.

A fundamental problem in diabetes has been an absolute lack of data on diabetes epidemiology and the evaluation and planning of diabetes services on a population basis. To examine patterns of diabetes hospitalization at the local level, the Canterbury Register of Insulin-Treated Diabetic Persons was therefore developed and used as the population database for the microscale analysis. This provided essential geographic, demographic and diabetes related characteristics of the insulin-treated diabetic population resident in the Canterbury Hospital Board area. Canterbury was chosen as the study area for two main reasons. First, it has a population appropriate in size and demographic characteristics to the requirements of the local level analysis, and second, it has a well developed diabetes care infrastructure which incorporates primary care services, community based diabetes education services, diabetes clinical outpatient services, and hospital inpatient care.

The Register showed, for example, that the overall prevalence of insulin-treated diabetes mellitus (ITDM) in the community was 3.3 per 1000 persons, with little difference between males and females. The ITDM population was elderly and ITDM was most prevalent in the 60-69 year age group. The majority of individuals were diagnosed in adulthood and over 80% of adult onset cases commenced insulin-therapy at diagnosis. These findings suggest that autoimmune diabetes (Type 1) is not just a disorder of youth but spans all age

groups. In addition, nearly 40% of the population had longstanding diabetes with durations of the disorder in excess of 15 years. This has important ramifications for the delivery and use of local diabetes services since it is these individuals who are most likely to have the long term complications of diabetes.

The ITDM population was followed over three years 1 January 1984 to 31 December 1986 and their rates of hospital use, irrespective of cause of admission, determined. During the three years, nearly 60% of the ITDM population were admitted to hospital. A large proportion of admissions (35%) were, however, precipitated by conditions apparently unrelated to diabetes. Overall, one in ten persons with ITDM was hospitalized each year for causes related to, or concomitant with, diabetes. Re-admission was common to many of these patients although not characteristic of any one group. Individuals were admitted from through out the Canterbury Hospital Board area, and from all parts of Christchurch city.

Length of stay varied considerably by patient age and cause of admission. On average, on any day during the study period, 8 beds would have been occupied by persons with ITDM admitted for problems associated with diabetes, and another four beds by ITDM individuals admitted for unrelated reasons. This level of bed occupancy is 3-4 times higher than that expected from prevalence of the disorder in the community.

There was considerable heterogeneity in the characteristics of those individuals admitted to hospital. Admission spanned all age groups and all durations of diabetes. The predominant user group was, as might be expected, the elderly. Individuals over 65 years of age were prevalent in the inpatient population and they stayed for prolonged periods of time. There was no difference in admission rates between males and females. Typical of general hospital admission patterns, elderly inpatients were more likely to be females, and the middle aged males.

On a per capita basis, those people with longstanding diabetes were most at risk for hospital admission, although people who had diabetes from 5 to 30 years contributed evenly to the actual inpatient caseload. This reflects both the increased occurrence of diabetes complications with increased duration of diabetes, and the fact that the majority of individuals in the ITDM population have durations of diabetes spanning this time period.

Overall, persons with ITDM admitted to hospital during the three year study period were, on average, older, and had had diabetes for longer than those individuals not admitted.

Causes of admission covered a spectrum of conditions, the importance of which varied both by patient age and duration of diabetes. This study reinforces previous findings (Fishbein et al, 1982; Brown et al, 1985; Isaacs and Scott, 1987) that a significant proportion of hospital admissions are precipitated by the acute

disorders of control either hyperglycaemia, ketoacidosis, infection or hypoglycaemia. These admissions involved persons of all ages. They did, however, prompt all the diabetes related admissions by persons under 20 years of age, and over 40% of admissions by females. While the role of social class was unclear in this analysis, those from the lower occupational group and unsettled social backgrounds, were also prone to admission from disorders of glycaemic control.

These acute causes of hospital admission are largely preventable through interventive strategies and diabetes management practices currently existing in the community. This pattern of hospital utilization would suggest that many of the Canterbury ITDM population have poor quality diabetes care and perhaps make inappropriate use of available ambulatory services.

In New Zealand, there is a distinct separation in the provision of diabetes care between the primary and secondary sectors. Patient access to specialist ambulatory diabetes and hospital inpatient services is mediated through the referral system. General practitioners are the gatekeepers to diabetes care. They were the direct source of referral of half of the 652 diabetes related admission events recorded during the study period. In addition, most patients accessed both specialist ambulatory diabetes services available in Canterbury, namely the Diabetes Outpatient Clinic and the Diabetes Education Centre, via their general practitioner. There was, however, a noticeable interaction in patient transfer between these two specialist services once patients had gained entry into the secondary

sector. Specialists played a key role in the re-referral of patients. Some 25% of hospital admissions came via specialist referral from hospital outpatient departments.

The role of the general practitioner versus the hospital specialist as a source of patient referral differed by precipitating medical event. General practitioners contributed to higher proportions of admissions for poor diabetes control and cardiovascular disease. Not surprisingly, admissions relating to the chronic complications of renal, peripheral vascular and eye disease, tended to come through specialist referrals from hospital outpatient departments.

Admission to hospital not only reflected the characteristics of individual patients but also features of general practice and specialist ambulatory diabetes services. The ITDM population made use of a large number of general practitioners. Nearly 60% of doctors cared for five or fewer persons with ITDM. Thus, many general practitioners may not have been familiar with or experienced in treating ITDM. In contrast, however, a relatively small number of doctors (8.3%) had attracted large numbers of patients (21.9%) into their practices.

In general, the patients most likely to be hospitalized were those in the care of young doctors new to general practice, or the older doctors who had been in practice for many years. The reasons for this are unclear, and no doubt reflect a number of factors, for



example, doctors' confidence in treating patients, the uncertainty of diagnoses, or rigor in patient management practices. These two doctor groups also had the highest proportion of (unreferred) patients entering hospital via the Accident and Emergency Department at the Christchurch Hospital.

Contrary to expectation, patients in the care of solo practitioners had the lowest rates of hospital use. This may reflect either poor detection of problems and therefore low rates of referral from their doctors to either outpatient departments or hospital, or increased scrutiny and more rigorous intervention in primary care. These features of general practice require further investigation.

Studies have documented both improvements in parameters of diabetes control (e.g. Muhlauser et al, 1983; Mazzuca et al, 1986) and reductions in hospital utilization (e.g. Miller et al, 1972; Moffitt et al, 1979; Fishbein, 1982) following service re-organization and patient attendance at diabetes educational programmes. This study revealed no overall difference in the proportion of individuals admitted to hospital between those groups of patients attending or not attending specialist diabetes services. This does not, however, imply service ineffectiveness but rather points to the complexity of the local diabetes care organization and differences in results gained from using different methodologies in evaluating health service outcomes.

In Canterbury, both the Diabetes Outpatient Clinic and the Diabetes Education Centre have dual functions in providing acute and remedial treatment of patients with existing problems, and in providing services with the express purpose of prevention and health maintenance. They have heterogeneous user populations ranging, for example, from recently diagnosed individuals with few problems to patients with longstanding diabetes and multiple diabetes complications. These groups place different levels of demand on hospital services.

As diabetes patient education has become established in the Canterbury area, the Diabetes Centre has captured larger proportions of the ITDM population (over 60% of persons in this study had attended educational programmes). Caseload selectivity for well motivated individuals with few diabetes problems, has been eroded over time with increasing patient numbers. Significantly more people who are at high risk to hospitalization are being referred for remedial and preventive care. It is difficult to predict what hospitalization rates might have been, if such services were not provided.

The Diabetes Centre also attracts a large proportion of newly diagnosed individuals. It may only be through longitudinal follow-up of these individuals over a 10-20 year period that the potential benefits of diabetes patient education on individual health status and requirements for hospital inpatient resources will be observed.

Overall, one in five persons in the ITDM population had attended neither of the two specialist diabetes services available in Christchurch. These non-attenders were on average older and had diabetes for a longer period of time than those people using both specialist services (40% of the population). This is indicative of recent trends in high rates of referral of young newly diagnosed patients to these facilities.

It is postulated that the group of patients not using specialist diabetes services is also comprised of two subsets: first, individuals who maintain good health, and therefore neither they nor their doctors perceive a need for attendance at specialist services; and second, individuals who may be at risk of disorders of control and the long term complications of diabetes but through incomplete surveillance in primary care, or problems of access, do not attend specialist facilities. The former group would be expected to be at low risk to hospitalization and the latter high. Overall, non-attenders exhibit similar rates of hospitalization to the groups of patients attending specialist services.

As stated in Chapter Six, reductions observed in hospital admission were not necessarily attributable to patient education per se but to service re-organization with increased emphasis on ambulatory care and greater control over patient entry into the hospital sector. The results presented in Chapter Eleven show that most ITDM patients enter hospital via referral from their general practitioner, from hospital outpatient departments (not necessarily

X

the diabetes clinic) and through accident and emergency services. It is perhaps not surprising that the introduction of diabetes patient education in Canterbury has not been reflected by reduced rates of hospitalization on a population basis given the characteristics of the local ITDM population, the fragmentation in the structure of diabetes care, and the lack of organized or planned control over the referral mechanisms which regulate hospital admission.

The potential benefits of patient education in reducing hospitalization and improving health outcomes of individuals may be best witnessed by following cohorts of new patients who have not been exposed to diabetes complications and who are managed totally within this modern philosophical approach to diabetes care. It is difficult to predict what hospitalization rates might have been, if diabetes patient education had not been introduced into the day-to-day management of the disorder over the last ten years.

### **12.3 RESEARCH SIGNIFICANCE**

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This thesis is significant for its exposition of managerialism in health care and for its extension of practical research on diabetes epidemiology and health care delivery.

Despite its apparent utility, geographers have not applied managerialism in the explanation of health care issues. This left a significant gap in our understanding of socio-spatial expressions of health and health care. Empirical realities are dialectically

determined by forces within and outside of the health sector. While, provider factors are acknowledged as being important, few studies have specifically examined the role of resource provision and the organization of the health system in determining health services utilization, and especially in relation to a particular health disorder.

This thesis argues that individual health care behaviour is conditioned by the organizational and societal framework in which care is sought and used. The probability of diabetic individuals using hospital services is, for example, conditional on the probability that their needs for care are translated into effective demand. This process is dependent not only on individual predisposing, enabling or illness factors but also on the organization and operation of the health care system. The health care system dominates individual utilization behaviour by controlling access: 1) via the beliefs and values that underpin the meaning of health and the need for health care; 2) through the supply of health care resources available for use; and 3) through the organization of services and access to care via the referral process.

While the medical profession may not be independent of forces operating within the political economy of health care, doctors clearly play a dominant role in determining individual opportunities at the local and regional levels. Managerialism derives its greatest value at the interface between allocators of resources and individual consumers. This interface is of utmost importance in health care. The explanation of realities in health, like hospital utilization,

necessitates the examination of the organizational structure of resource allocation.

The understanding of the organizational form that health care systems assume and the distribution of conflicts and benefits that ensue, requires the identification of the main actors involved and an understanding of the power distribution and dynamics that exist between them. Factors internal to the health system also need to be located within the wider social, political and economic imperatives of society.

The dominance of, and the control exerted by, the medical profession is the singularly most important factor in determining patient access to diabetes care. Doctors, irrespective of practice setting, are the gatekeepers to care and the day-to-day managers of the 'diabetes health care system'. They mediate between the demand for care in different sectors, a demand which is engendered in part by the system itself and the supply of resources available for use.

Few studies have examined issues located at the interface between the primary and secondary sectors. This thesis is concerned with inequity in patient access to hospital care. It is clear that the apparatus through which diabetes care is received is not a single health service but rather an inter-organizational network of separate services available for use in both the primary and secondary sectors. The interaction between services, expressed through the referral system, is of paramount importance in controlling hospital utilization.

Doctors as managers and as gatekeepers to care, operate at the interface between health sectors. In diabetes, interaction occurs at the boundaries between primary care, ambulatory community and outpatient services, and hospital inpatient services. If available health facilities are to be used effectively in improving health outcomes of diabetic individuals, then the functions of each service need to be reassessed and appropriately understood in relation to the total system and not in isolation.

Despite an apparent re-orientation in the philosophy of diabetes care, and calls for community-based care, power structures demand service provision remains heavily institutionalized. This situation is not unique to diabetes. There are, for example, parallels in the de-institutionalization of mental health care (Malcolm, 1987; Dear and Wolch, 1987; Smith, 1988). Diabetes educational services were superimposed on the existing service structure with little change in organizational mechanisms or the distribution of power within the system as a whole.

The supply of resources in the hospital sector induces use through affecting the medical practices of both general practitioners and hospital specialists. Doctors respond to the number of hospital beds and specialist facilities available for use and to hospital administrative policies influencing the ease with which they can admit patients. The aims of this thesis were specifically to assess the influence of Roemer's Law in hospital care for diabetes and the

impact of the organization of diabetes care on patterns of hospital use at the local level.

An important adjunct to this study, is future research on the mechanics through which Roemer's Law operates at the local level and the behavioural processes through which patient referral is granted. As guidelines and audit procedures are poorly developed, doctors will differ in their clinical evaluation of patients. Professional uncertainty, the quality of medical surveillance, perception of other services, and the availability of resources to doctors in primary care, will reflect in the rates at which doctors admit their patients. When hospital beds are available, a doctor may simply find it more expedient to admit a moderately ill person than to care for him/her on an ambulatory basis in primary care (Connell et al, 1984). Other doctors may have admission practices which tend to operate independent of resource or administrative factors within the hospital sector. In New Zealand, poor primary care subsidies may encourage the patient to be admitted to 'free' public care.

Future research, designed to elucidate the mechanisms through which Roemer's Law operates, could be based upon a comparative study of the hospitalization practices of doctors working in areas with differing levels of hospital bed supply. This could facilitate an investigation of the way in which doctors react to different contextual arrangements and constraints at the macro-level on their behaviour.



The role of the medical specialist in determining patient entry into hospital also needs further elaboration. Given the medical characteristics of diabetes, and the professional interests of medical specialists, it is perhaps not surprising that these doctors emerged as a key factor in explaining rates of diabetes related hospitalization. However, the actual mechanisms through which the specialist medical work-force influences hospital utilization requires further investigation.

Further to, and in association with, these future research tasks, is also the need for a closer inspection of the relationship between community care initiatives, such as diabetes education, and trends towards the de-institutionalization of health care, and the operation of Roemer's Law within and outside the public hospital sector. Increased efficiency and effectiveness of health services will only occur if the organizational mechanisms through which patients access care, and health services are financially and socially rewarded, are properly understood and the necessary changes made. To date, there have been problems in the implementation of shared care programmes in diabetes. However, improvements in the overall quality of diabetes care and, thus, in the long term health outcomes of diabetic individuals, may be best facilitated through a service approach in which primary and specialist services are truly integrated and consumer interests well represented.

This thesis has contributed directly to furthering knowledge on diabetes epidemiology and the provision and use of diabetes care.

Use of health services by diabetic persons had not been extensively researched despite the impact of the disorder.

Unlike many studies, this research adopted a population based approach to the examination of hospital use. This choice over the service oriented approach reflected a basic concern for inequities in the health outcomes of diabetic persons as measured by their requirements for hospital care. The results of the research have been summarized above and discussed in detail in the body of the thesis. The significance of this work lies in the development of the methodology for investigating diabetes related hospitalization, in the establishment of the Canterbury Register of Insulin-Treated Diabetic Persons, in the identification and measurement of hospital use both at the regional and local levels, and in the application of managerialism as a mode of explanation of these patterns.

It is clear that the evaluation and planning of health services used in the care of diabetes have been gravely deficient in New Zealand. Only through the improved understanding and appreciation of the epidemiology of diabetes and the organization of diabetes care, will health services be appropriately targeted and the health needs of all persons with diabetes met.

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## APPENDICES

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## **APPENDIX A**

### **DIABETES MELLITUS**

#### **A.1 DIABETES PATHOGENESIS**

Diabetes is heterogeneous in its pathogenesis. "In recent years it has become abundantly clear that diabetes is not a single disease but a syndrome consisting of many disorders characterized by hyperglycaemia, other abnormalities of intermediary metabolism, and in the majority of cases, by the chronic complications of diabetes mellitus, microangiopathy, macroangiopathy and neuropathy" (Fajans, 1982, p.229). Diabetes is associated with a lack of insulin, an abnormality in carbohydrate metabolism, disorders in fat and protein metabolism, metabolic changes at the cellular level and defects in the vascular system (Rodriquez, 1982). Major changes occur in blood composition and body tissue from untreated persistently high blood sugar levels.

In normal individuals, a series of complex mechanisms operate to maintain carbohydrate homeostasis in the steady state necessary for normal metabolism. Co-ordinated regulatory metabolic processes in body tissue (e.g. in skeletal muscle, adipose tissue, heart and brain) keep the level of glucose in the blood within the narrow range of 3.3 - 6.7mmol/L (Rodriquez, 1982). Glucose provides the metabolic energy used in maintaining all vital processes, regulating

body temperature, maintaining and replacing tissue, and for the energy used in voluntary movement. Food ingestion and gluconeogenesis in the liver supply glucose to the body.

Diabetes results from an absolute or relative deficiency of the hormone insulin. Insulin permits the uptake of glucose from the bloodstream and facilitates its transport through cell membranes of insulin sensitive tissues. These actions are triggered by insulin binding to receptors on target cells. Insulin is produced in the B-cells of the islets of Langerhans in the pancreas. The pancreas secretes sufficient insulin to maintain a basal level that will control and suppress catabolic processes. When blood glucose levels rise, as after food ingestion, the basal secretion of insulin is augmented. When the level of circulating glucose is returned to normal or is low, the release of insulin by the pancreas is reduced (Rodriquez, 1982).

A deficiency of active insulin arises either as the result of defective endogenous insulin production which leads to a total or almost total lack of insulin, hence an absolute deficiency, or through the impairment in the activity of available endogenous insulin at the receptor and/or intracellular sites of insulin sensitive cells (relative deficiency). Usually these two factors of insulin production and resistance operate to a greater or lesser extent. The lack of insulin leads to extensive disturbances in carbohydrate, fat and protein metabolism. In the absence of insulin action, the body's utilization of glucose is greatly diminished. Glucose transport into cells is

inhibited with resultant hyperglycaemia as blood glucose concentrations increase in both the fasting state and in response to glucose loadings. A lack of insulin initiates counter-regulatory mechanisms and the ability to decrease hepatic glucose production is lost. This further exacerbates the state of hyperglycaemia. Insufficient insulin action accompanied by increases in contra-insulin hormones (glucagon, epinephrine and cortisol) causes anabolic and catabolic processes to become unbalanced.

Without insulin, glucose is locked into the bloodstream and cannot therefore be used effectively as the metabolic fuel. Glucose enters cells slowly by a downhill diffusion gradient and therefore, blood sugar levels are progressively raised in insulin deficiency. Consequently, there is the catabolic tendency towards the breakdown of stored body fats and proteins to ensure the fuel supply within cells is maintained. The increased mobilization of stored energy supplies results in elevated blood concentrations of free fatty acids, triglycerides and ketones. The production of keto- and fatty acids in the liver becomes very high because of insulin deficiency and inadequate breakdown for energy. Because of their acidity, the body must use bicarbonate for their neutralization (Levine, 1982). Peripheral tissues are however incapable of utilizing all the ketone bodies produced. Excess ketones are excreted in the urine and with the loss of bicarbonate, acidosis ensues.

When the renal threshold is surpassed, excessive circulating glucose is excreted through the kidneys into the urine (glycosuria). This is accompanied by the loss of water (polyuria) as well as electrolytes. The resulting dehydration in the patient leads to an excessive thirst and the consumption of abnormal quantities of fluids. Appetite increases as the need to replace the energy lost through glycosuria becomes more pronounced. Loss of body protein causes weight loss and lethargy. If more body protein is broken down than can be resynthesized, the growth and repair of tissue is impaired and the body's ability to fend off infection is reduced. Thus, if diabetes is left untreated and normal metabolism is not restored, the catabolic breakdown of the body's glucose, fat and protein stores occurs and the pathway to ketoacidosis is initiated. Severe diabetic ketoacidosis can then lead to coma and death.

## A.2 CLASSICAL SYMPTOMS OF DIABETES

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Dehydration

Excessive Thirst (Polydipsia)

Polyuria

Glycosuria

Increased Appetite (Polyphagia)

Weight Loss

Impaired Vision

(Refractive Changes in the lens)

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Bacterial Infection

Lethargy (Drowsiness, Stupor)

Nausea and Vomiting

Laboured Respiration

Abdominal Pain

Coma



### A.3 DIAGNOSTIC CRITERIA FOR DIABETES MELLITUS

	Glucose Concentration, mmol/litre (mg/dl)			
	Whole blood		Plasma	
	Venous	Capillary	Venous	Capillary
casual, random sample	$\geq 10.0$	$\geq 11.1$	$\geq 11.1$	$\geq 12.2$
or 2hrs after glucose load in OGTT <sup>1</sup>	( $\geq 180$ )	( $\geq 200$ )	( $\geq 200$ )	( $\geq 220$ )
Fasting value	$\geq 6.7$	$\geq 6.7$	$\geq 7.8$	$\geq 7.8$
	( $\geq 120$ )	( $\geq 120$ )	( $\geq 140$ )	( $\geq 140$ )

1. Oral Glucose Tolerance Test establishes a patient's response to a glucose challenge.

These criteria (established by the US National Diabetes Data Group) have been adopted by the WHO Expert Committee on Diabetes Mellitus (1985) as the international standards for diagnostic confirmation of Diabetes Mellitus. There is little uncertainty in a diagnosis of diabetes if a blood glucose reading meets these criteria (Keen, 1982).

## **A.4 DIABETES AETIOLOGY**

### **A Factors associated with NIDDM**

**1) Obesity:** Obesity is promoted as the most powerful diabetogenic factor in middle and old age. Both the degree and duration of obesity appear to increase the risk of developing NIDDM. Obesity induces insulin resistance through the reduction in the number of insulin receptors on target cells, or as in the majority of cases through post-receptor changes which decrease glucose transport or impede intracellular glucose metabolism. The role of obesity is not unequivocal. Comparisons of age-specific prevalence rates of diabetes in lean and obese Nauruans suggest that the degree of obesity influences the time of NIDDM onset as opposed to whether or not diabetes develops. Obesity is itself a heterogeneous disorder and this confounds its role in diabetes aetiology. Research is needed to establish whether the prevention of obesity can prevent the occurrence of most NIDDM and at what stage of life obesity is most diabetogenic.

**2) Dietary Factors:** Cellular defects in insulin sensitivity and action in NIDDM patients are partly the consequence of dietary composition, excessive energy supplies and increased fat storage. The overall nutritional status of individuals, quantitative dietary factors like total caloric intake, and qualitative aspects such as intake of simple sugars, refined carbohydrate, fats, alcohol and fibre, all

seem to contribute to the development of NIDDM. This is particularly evident in populations who have changed from traditional dietary patterns of fresh fruit and vegetables, and fish and meats, to diets high in sugar, flour, fat, processed foods, soft drinks and alcohol, i.e. to diets high in calories but of dubious nutritional value. Intake of excessive calories relative to energy expenditure leads to weight gain, increase in adiposity, obesity, insulin resistance and hyperglycaemia. Simple sugars and refined carbohydrates also present an immediate glucose challenge that demands rapid metabolic response to inhibit pronounced and abrupt rises in blood glucose concentrations. The mechanisms of insulin production and release are for slow production of insulin with storage in granules and release on demand. Repeated rapid demands may damage this apparatus.

**3) Physical Inactivity:** Exercise plays a major role in physiological and metabolic processes. Normal cellular mechanisms associated with voluntary movement can be disrupted through physical inactivity and thus the interaction between insulin and cell receptors impaired. Higher levels of muscular activity, more typical of pre-industrial times, appear to act as protective factors against diabetes. In some situations, the lack of physical exercise is more diabetogenic than either diet or obesity. An exercising muscle has a smaller demand for insulin than an inactive one, thus 'sparing' insulin production. Therefore it may last longer. The interaction of exercise, diet and

obesity is however rather complex and the independent role of each does need much greater clarification.

**4) Stress:** Stress is also regarded as an acquired risk to diabetes (including IDDM). Fluctuations in blood glucose levels in diabetic patients under stress and during the release of insulin antagonistic stress hormones such as adrenalin and corticosteroids, and observations that diabetes often presents in individuals during or after intense psycho-social stress, indicates that factors of stress cannot be discounted in the aetiology of diabetes. Physical and psychological stress lead to hormonal changes which appear to affect glucose metabolism and impair insulin secretion and insulin action. (Zimmet, 1979; Zimmet, 1982; Zimmet and King, 1982; Zimmet and King, 1985; WHO Diabetes Study Group, 1985).

## **B. Aetiological Aspects of IDDM**

**1) Genetics:** Persons with IDDM, particularly Caucasians, tend to have particular histocompatibility locus antigens (HLA antigens). These are proteins found on the surfaces of many body cells including the pancreatic B-cells. The HLA antigens act as genetic markers to diabetes since the types of HLA antigens people have reflect the genes they inherit (Ginsberg-Fellner, 1981). Over 90% of Caucasian children studied who have IDDM, have the HLA-DR alleles of DR3, DR4 and/or a combination of both (Eisenbarth, 1985; WHO Diabetes Study Group, 1985; Pyke 1986). The genes which are associated

with the HLA antigens are located on chromosome 6. These genes appear to control the body's immune responses whilst the HLA antigens reflect the body's ability to fight both bacterial and viral infections (WHO Diabetes Study Group, 1985).

The inheritance of these antigens does not mean that a person will automatically develop IDDM, rather he or she is more susceptible than an individual who does not have them. In the USA population for example, at least one person in three has either DR3, DR4, or both, but less than 1% of these individuals will develop IDDM (Ginsberg-Fellner, 1981; WHO Diabetes Study Group; 1985; Pyke, 1986). If genetic susceptibility was the only aetiological factor of IDDM, then the concordance rate between identical twins would be close to 100%. Barnett and co-workers (1981) found that only 54% of pairs of identical twins where at least one twin had IDDM were concordant. Thus, other factors must also play a major role in the development of IDDM.

**2) Immune Factors:** The HLA association with IDDM suggests the genetic element in IDDM aetiology is immunological (Pyke, 1986). IDDM is a consequence of hypoinsulinaemia produced by the destruction of pancreatic B-cells via autoimmune processes. Three theories were advanced in the early 1980s:-

- 1) Certain antigens, either the HLA antigens or others linked to them, fail to alert the body's immune system that foreign antigens, e.g. viruses, are invading. The body's defense system is therefore not aware that abnormal cells are present, and the viral attack against the B-cells is not prevented. The viral deactivation and destruction of the B-cells results in the reduction of insulin production, and diabetes ensues. This seems very unlikely however.
- 2) Particular HLA antigens may act as receptors to foreign antigens e.g. a virus might attach to the HLA-DR3 or DR4 antigen on the surface of target cell or close by because the DR antigens somehow emit messages that signal the environment is hospitable. Then the virus destroys its 'host' cells; and
- 3) Viral infections may not damage the B-cells directly, rather, certain HLA associated antigens may allow the viruses to penetrate the cell membranes and somehow change the chemical characteristics of the cells. The mutated cells are recognized as foreign bodies and antibodies are released to deactivate and destroy them. An autoimmune response is thus initiated in which the body acts against its own cells as if they were alien objects (Ginsberg-Fellner, 1981).

This latter view is now thought to be the most likely explanation as antibodies can be identified against B-cells. A variety of antibodies react with antigens in the islets of Langerhans and certain antibodies such as islet-cell cytoplasmic antibodies have been found in the serum of the majority of IDDM patients (60-85%) at the time of their diagnosis (Bennett, 1985; WHO Diabetes Study Group, 1985; Pyke, 1986). In addition, these antibodies can be detected prior to the actual onset of IDDM suggesting that the destruction of B-cells and the development of IDDM in susceptible individuals is a protracted process (Bennett, 1985).

The role of viruses in the causation of IDDM is still very much under question. Viral infections have been implicated in the causation of IDDM largely from experiments with animals and through circumstantial evidence from case reports noting temporal relationships between the development of IDDM and viral infections like mumps, Coxsackie B4 and rubella (Yoon and Ray, 1985; Bennett, 1985). The presence of viral antibodies has been noted in the sera of newly diagnosed diabetic patients, and *in vitro* studies do reveal that B-cells in culture are susceptible to several common human viral infections. Furthermore, the capacity of the viruses to infect the B-cells is enhanced by repeated passage through the cell cultures (Yoon and Ray, 1985). It seems likely that repeated viral attacks would be needed to result in cumulative B-cell damage in genetically susceptible individuals. Yoon and Ray conclude "IDDM most likely is not a single disease but several diseases with different aetiologies.

Therefore if viruses can cause diabetes, they may be only one of the multiple causes and more than one virus or virus group may be involved" (1985, p.43). They suggest that further research should look for viruses which produce cumulative insults, for viruses that produce slow or persistent infections, and for viruses that trigger autoimmune responses.



**A5 SYMPTOMS OF HYPOGLYCAEMIA**

(Blood sugars below normal levels 3.6-6.8 mmol/L).

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***Adrenegic Effects***

tremors  
hunger  
weakness  
palpitations  
perspiration

***Neural Effects***

clouded senses  
irritability  
acute confusion  
fits  
acute neurological syndromes  
unconsciousness (coma)

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**Note:** The occurrence and extent of these symptoms will vary between individuals and in the same person at different times.

## **APPENDIX B**

### **THERAPEUTIC INTERVENTION: DIET, EXERCISE AND INSULIN ACTION**

#### **1. Diet**

Metabolic control is directly affected by qualitative and quantitative factors of diet, making dietary therapy essential for all diabetic individuals. Dietary intervention aims: 1) to avoid abnormal excursions in blood glucose levels following food ingestion; 2) to improve insulin resistance and facilitate effective insulin action through reduction in obesity and maintenance of acceptable body weight; and 3) to promote nutritional well-being. Although, rigid 'diabetic diets' are a factor of the past, the amount of attention paid to food composition, daily caloric intake, frequency and timing of meals is considerable. The required change in nutritional behaviour is substantial for many individuals.

In New Zealand and overseas, diabetic patients are strongly advised to adopt diets most prudent for the care of their diabetes. Such diets exemplify the nutritional principles and dietary habits being advocated for healthy eating for all (e.g. high fibre, low fat, low salt, high in complex but low in simple carbohydrates, moderate consumption of alcohol). Diabetic individuals must be particularly

aware of the glycaemic effects of different foods and incorporate or restrict food substances accordingly. For example, foods made up of simple sugars and starches, which contribute to a large part of western diet, are best avoided. These are rapidly absorbed into the bloodstream and lead to abrupt and marked fluctuations in blood glucose levels. Diabetic patients are also encouraged to have a number of smaller meals spread through out the day so as to avoid unnecessary glucose challenge and not overtax their metabolic system.

Because the pathogenesis of NIDDM centres on insulin resistance, total caloric restriction is very important for overweight and obese NIDDM patients. Weight reduction improves insulin resistance and carbohydrate intolerance. Dietary therapy is all that is needed to overcome basic physiological disturbances in about half of all NIDDM patients.

Patient compliance with diet is notoriously poor. Dietary therapy often detracts from the personal pleasures of eating and interferes with normal social interaction. Dietary expectations established by health professionals cannot always be fulfilled by the patients. Unrealistic dietary aims, such as ideal body weight or food and calorie restrictions, tend to patient non-compliance and failure in treatment. For diet to be an effective therapeutic tool, it must be based on individual nutritional needs, personal and family food preferences, and the patient's social, cultural and economic background. Furthermore, diabetic patients must attempt to change their nutritional habits in a commodity and

consumer-oriented world in which food advertising, production and selling comprises no small part!

## **2. Exercise**

The effects of exercise on diabetes control are two fold: 1) the acute impact of physical exertion on glycaemic control; and 2) long term health benefits of physical training. Physical activity is important in the management of diabetes because it represents voluntary (cf. metabolic) expenditure of energy and utilization of blood glucose. Glucose is used in increasing amounts as the main energy substrate by exercising muscle. Homeostasis is maintained, despite changes in energy requirements during exercise, through the inhibition of insulin secretion and increased hepatic glucose production.

Normal counter-regulatory controls are impaired in IDDM. As a consequence, exercise can induce two metabolic responses: 1) Exercise exacerbates poor control because when insulin is deficient, as evidenced by hyperglycaemia, hepatic glucose production becomes excessive and cellular uptake of glucose is restricted; and 2) If hyperinsulinaemia prevails, exercise augments excessive levels of glucose uptake which is not matched by increased hepatic glucose production. This results in hypoglycaemia.

Exercise induced hypoglycaemia during and after exercise is a major problem for many IDDM patients especially if they have near-

normal blood glucose levels prior to the start of physical activity. Exercise plays an important role in metabolic homeostasis, but it is virtually impossible to prescribe because so many individual factors come into effect. Several studies have documented that participation in physical activity does not lead to overall improvement in control because exercise has a variable impact on blood glucose levels.

The effects of exercise differ between IDDM and NIDDM. NIDDM patients do not experience these metabolic problems because of the pathophysiology of their disorder, but like their IDDM counterparts, they do benefit from the more general and long term effects of exercise on cardiovascular fitness and on personal well-being. Physical training augments the biological effects of insulin, improves cellular insulin sensitivity, and helps to reduce obesity.

### **3. Insulin Action**

Exogenous insulin administration and use of oral hypoglycaemic agents represent the two forms of pharmacological intervention in diabetes. Insulin therapy was first introduced into diabetes management in 1922 and oral hypoglycaemic agents in the mid 1950s.

The only chance of survival for persons with IDDM is the replacement of the lost endogenous insulin supply. This is achieved predominantly through multiple subcutaneous injections of insulin daily although there are several other insulin delivery systems in use (e.g.

continuous insulin infusion pumps). Insulin which is manufactured by several large international pharmaceutical companies (e.g. Eli Lilly, Novo, Nordisk-Wellcome) comes from several sources. It is traditionally extracted from pork and beef pancreas, but is also now biosynthetically produced from recombinant DNA. There are many types of insulin available on the market. These differ in chemical structure, duration of action, and purity.

Long acting insulin compounds are used commonly to provide a stable continuous basal level of circulating insulin, with short acting insulin being injected as a bolus prior to each meal. Insulin regimes attempt to mirror physiological insulin release. Unfortunately, exogenous insulin is not delivered in a physiological manner and normal physiological processes are not replicated. The action of exogenous insulin is affected by its potency and rate of dispersal to tissues via the blood stream. Insulin absorption is often erratic being affected by anatomical injection site and changes in local blood supply. There remain large inter- and intra-individual variations in insulin kinetics which frustrates the establishment of treatment regimes and normalization of blood glucose levels.

Furthermore, insulin therapy can be iatrogenic and is potentially lethal. The most significant hazard of insulin treatment is the development of hypoglycaemia. Most IDDM patients are continually at risk to hypoglycaemia. This is a major worry for patients and their families. Excessively low blood sugars can lead to serious injury and

even death, and also severe hypoglycaemia has a cumulative impact on cerebral functioning.

Insulin allergies, antibody formation and mediated insulin resistance, lipoatrophy and lipohypertrophy are still associated with insulin treatment although their occurrence has diminished with the introduction of highly purified insulins in the 1970s and 'human' insulin in the 1980s. A subtle but important iatrogenic effect of insulin therapy is an insulin-induced increase in satiety which promotes weight gain. This can create a vicious circle of weight gain, increasing insulin resistance, deterioration in glycaemic control and poor dietary compliance, increased insulin dose and further weight gain. This problem seems to be common among young females who are already under a great deal of societal and peer group pressure with respect to appearance and body image.

Oral hypoglycaemic agents have been used since the 1950s in the treatment of NIDDM patients in whom diet and exercise has not yielded satisfactory glycaemic control. These drugs are not insulin, rather, they enhance endogenous insulin action and therefore are only useful in patients who have substantial insulin production (Ramirez, 1982). The pharmaceutical industry has established a large market for these drugs with many different oral hypoglycaemic agents now being produced (see World Book of Diabetes in Practice Vol 2, Krall LP (Ed), 1986, p76-78, for a list of oral hypoglycaemic compounds available world-wide). These

drugs are essentially divided into the sulfonylureas and biguanide derivatives.

The sulfonylurea agents appear to: 1) enhance basal and nutrient stimulated insulin secretion which improves the delayed and blunted insulin release typical of NIDDM; and 2) increase peripheral uptake of glucose by improving receptor sensitivity to insulin and post-receptor activity (Breidahl, 1982; Lebovitz, 1986). In comparison, biguanides tend to: 1) inhibit or delay intestinal absorption of glucose; 2) decrease hepatic gluconeogenesis; and 3) increase tissue utilization of glucose by increasing the number of insulin receptors and their affinity to insulin (Breidahl, 1982; Czyzyk, 1986). These two drug types are used individually as the sole antidiabetic agent, or in some cases in combination with each other and infrequently with insulin.

Like insulin therapy, use of oral hypoglycaemic agents is not without its problems (Skyler, 1982). The most serious is patients treated with biguanides are at increased risk to lactic acidosis (Czyzyk, 1986; Menhert, 1982). This actually led to the biguanides phenformin and buformin being withdrawn from the US and several other markets. Lactic acidosis is a life threatening condition - mortality approaches 50% in elderly patients! Part of the increased health risk associated with this form of treatment can be attributed to inappropriate physician prescription of the drug. There are a number of contraindications to the use of biguanide derivatives which if ignored are likely to lead to the over-production of lactate.



In addition, there are side-effects associated with oral hypoglycaemic agents, especially gastro-intestinal disturbances and some patients are at risk to hypoglycaemia. Many of the patients on oral antidiabetic medication may be described as multi-drug users and are therefore subject to unfavorable drug interactions. Furthermore, as Lebovitz states "These drugs are an adjunct to dietary management and are rarely effective if some type of dietary management is not part of the therapeutic regime"(1986, p74). Although sulfonylureas may provide effective treatment for several years, secondary drug failure may occur after an extended period of use (Breidahl, 1982).

## APPENDIX C

### C.1 INTERNATIONAL CLASSIFICATION OF DISEASES: ICD CODE 250 DIABETES MELLITUS

#### 250 Diabetes Mellitus

The following fifth-digit subclassification may be used, if desired, with category 250:

- .0 adult-onset type
- .1 juvenile type
- .9 unspecified whether adult-onset or juvenile type

Excludes: neonatal diabetes mellitus (775.1); nonclinical diabetes (790.2); when complicating pregnancy, childbirth or the puerperium (648.0).

#### 250.0 *Diabetes mellitus without mention of complication*

Diabetes mellitus without mention of complication or manifestation classifiable to 250.1-250.9. Diabetes (mellitus) NOS.

#### 250.1 *Diabetes with ketoacidosis*

Diabetic:	)	
acidosis	)	without mention of coma
ketosis	)	

#### 250.2 *Diabetes with coma*

Diabetic coma (with ketoacidosis). Diabetes with hyperosmolar coma.

250.3 *Diabetes with renal manifestations (581.8, 582.8, 583.8\*)*

Diabetic nephropathy; Kimmelstiel-Wilson syndrome; Intra-capillary glomerulosclerosis.

250.4 *Diabetes with ophthalmic manifestations*

Diabetic:

cataract (366.4\*)

retinopathy (362.0\*)

250.5 *Diabetes with neurological manifestations*

Diabetic:

amyotrophy (358.1\*), Diabetic polyneuropathy (357.2\*)

mononeuropathy (354.-, 355.-\*)

250.6 *Diabetes with peripheral circulatory disorders*

Diabetic:

gangrene (785.4\*)

peripheral angiopathy (443.8\*)

250.7 *Diabetes with other specified manifestations*

Excludes: intercurrent infections in diabetic patients.

250.9 *Diabetes with unspecified complications*

(Source: 9th (1975) Revision WHO ICD)

## **C.2 TECHNICAL NOTES TO CHAPTER SEVEN**

Much of the data used in Chapter Seven to define area population attributes was extracted from Department of Statistics publications on New Zealand Census of Population and Dwellings. The Department's publication "1986 Census of Population and Dwellings, Series D, Report 3, General Information" provides a full list of the definitions and terms used in the 1981 and 1986 censuses, and describes changes in coverage and concepts between the censuses. The following provides technical notes on population variables used.

### **(1) Population Definitions**

The usually resident New Zealand population was used as the population denominator in all per capita calculations. This includes all persons enumerated in New Zealand on census night who are normally domiciled in New Zealand. Persons who usually reside overseas are excluded. The shipboard population (persons enumerated on board vessels in New Zealand waters on census night) were also excluded. Discrepancies in the population figures used in Chapter Seven and those presented in health statistics publications arise because the latter use census or estimated total populations (i.e. de facto population present at the place of enumeration which includes overseas residents and shipboard persons). Most of the tables produced by the Statistics Department pertain to the New Zealand Resident population which was the most appropriate denominator for a patient as opposed to a service-oriented study.

Note, however, the national data on hospitalization was extracted from publications using mean total population estimates.

Hospital board populations were calculated in 1976 and 1981 from their constituent counties and urban areas, and were obtained directly for 1986 from the "1986 Census of Population and Dwellings, Series B, Report 26, Hospital Board Districts and Health Districts". Data were extracted by sex and age. Board populations were estimated for non-census years using simple linear interpolation between the two enclosing census years, e.g. 1979 population estimate is the sum of the 1976 population plus 0.6 times the change in population between 1976 and 1981, or 1985 estimate is the sum of the 1981 population plus 0.8 times the change in population between 1981 and 1986. This method of estimation was used to derive all the data for non-census years for the demographic and socio-economic indicators used in the macro-analyses.

The board populations from 1979 to 1986 are given in the table below.

TABLE C.2.1

## HOSPITAL BOARD POPULATIONS (N.Z. RESIDENT POPULATIONS)

Area	1979	1981	1981	1982	1983	1984	1985	1986
Auckland	806815	813570	820325	831648	842972	854295	865619	876942
Canterbury	338844	338496	338148	340231	342313	344396	346478	348561
Otago	124281	123012	121743	121538	121334	121129	120925	120720
Waikato	320751	322146	323541	325611	327681	329751	331821	333891
Wellington	338102	337114	336126	337256	338386	339515	340645	341775
Cook	41022	41073	41124	41111	41098	41084	41071	41058
Hawkes Bay	122740	123454	124168	124663	125159	125654	126150	126645
Nelson	64341	64724	65106	65792	66479	67165	67852	68538
Northland	109134	110643	112152	114709	117265	119822	122378	124935
Palmerston N.	127264	127973	128682	129569	130456	131342	132229	133116
Sth Canterbury	59928	59517	59107	58411	57715	57018	56322	55626
Southland	113148	113310	113472	113240	113008	112775	112543	112311
Taranaki	98080	97901	97722	98674	99626	100579	101531	102483
Tauranga	71263	73043	74823	76789	78754	80720	82685	84651
Wanganui	74389	74111	73833	73803	73773	73743	73713	73683
West Coast	33324	33220	33117	33242	33367	33491	33616	33741
Ashburton	24936	24864	24792	24764	24736	24707	24679	24651
Bay of Plenty	45477	45887	46298	46510	46722	46934	47146	47358
Dannevirke	12501	12264	12027	12225	12423	12621	12819	13017
Marlborough	32235	32683	33132	33320	33508	33695	33883	34071
South Otago	16795	16694	16593	16384	16174	15965	15755	15546
Taumaranui	12343	12368	12393	12352	12310	12269	12227	12186
Thames	34461	34854	35247	36040	36832	37625	38417	39210
Vincent	10298	10603	10908	11369	11831	12292	12754	13215
Waipawa	13035	13003	12972	12993	13014	13035	13056	13077
Wairarapa	45377	45307	45237	45000	44763	44526	44289	44052
Waitaki	21764	21595	21426	21397	21368	21340	21311	21282

Note: Excludes Maniototo and Waipau Hospital Boards.

**C.3 LONGSTAY OUTLIER EVENTS****TABLE C.3.1****LONG-STAY OUTLIER CELLS:****DISCHARGES AND PATIENT DAYS BY AGE, SEX AND YEAR**

		Age Group (Years):					Contribution to Annual Totals
		<60	60-69	70-79	80+	Total	
1979	M - disch.	3	7	11	5	26	1.7
	- days	362	1066	5025	2429	8882	27.7
	F - disch.	5	3	17	6	31	1.7
	- days	566	504	4813	1275	7158	22.2
1980	M - disch.	4	9	15	4	32	2.1
	- days	599	1900	2966	2923	8388	27.2
	F - disch.	2	10	13	20	45	2.9
	- days	365	4883	2202	3800	11250	31.2
1981	M - disch.	1	4	31	3	39	2.6
	- days	127	602	5620	1002	7351	25.1
	F - disch.	4	1	4	24	33	2.2
	- days	872	158	434	17317	18781	46.3
1982	M - disch.	3	21	17	15	56	3.6
	- days	471	3177	3904	4486	12038	36.4
	F - disch.	0	6	6	17	29	1.8
	- days	0	1100	1327	4391	6818	22.9
1983	M - disch.	6	20	14	17	57	3.5
	- days	592	5375	1781	7608	14816	40.5
	F - disch.	3	1	2	9	15	0.9
	- days	942	748	1497	5752	8939	27.3
1984	M - disch.	3	6	12	11	32	2.1
	- days	446	1709	3276	2616	8047	27.1
	F - disch.	4	3	7	7	21	1.2
	- days	611	503	4109	5677	10900	31.6

**TABLE C.3.1**  
**CONTINUED...**

		Age Group (Years):					Contribution to Annual Totals	
		<60	60-69	70-79	80+	Total		
1985	M	- disch.	3	8	24	12	47	3.1
		- days	482	806	5566	3645	10499	32.4
	F	- disch.	2	4	7	19	32	2.0
		- days	236	1217	939	7780	10172	30.7
1986	M	- disch.	17	7	22	10	56	3.9
		- days	3733	1050	4158	1817	10758	35.5
	F	- disch.	5	4	8	24	41	2.6
		- days	832	1066	1814	8268	11980	37.7
Total	M	- disch.	40	82	146	77	345	2.8
		- days	6812	15682	32296	25968	80779	31.7
	F	- disch.	25	32	64	116	247	1.8
		- days	4424	10179	17135	54260	85998	31.8



TABLE C.3.2

**CONTRIBUTION OF "LONG-STAY" EVENTS TO DISCHARGES AND  
PATIENT DAYS FOR HOSPITAL BOARD POPULATIONS  
(GROUPED BY THE NUMBER OF YEARS OUTLIERS OCCURRED)**

<b>Board</b>	<b>Number of Discharges Involved</b>	<b>% Total Discharges 1979-1986</b>	<b>% Total Patient Days 1979-1986</b>
(a) None, 1 or 2 Years			
Vincent	0	0	0
Marlborough	1	0.4	13.4
Cook	2	0.5	6.8
Bay of Plenty	4	0.9	27.4
Ashburton	5	1.7	29.1
Waitaki	6	2.6	24.6
(b) 3 or 4 Years			
South Canterbury	4	0.5	16.4
Canterbury	10	0.5	7.6
Otago	14	1.2	11.5
Taumaranui	3	1.5	26.7
Nelson	9	1.6	32.9
Waipawa	4	3.2	57.1
Dannevirke	6	4.4	76.6
(c) 5 or 6 Years			
West Coast	9	1.4	28.1
Thames	11	2.2	27.6
Tauranga	17	3.3	42.8
South Otago	14	7.1	60.9
(d) 7 or All Years			
Hawkes Bay	24	1.6	15.8
Waikato	39	1.7	30.1
Northland	23	1.8	37.9
Auckland	102	2.1	20.7
Taranaki	30	2.5	24.2
Palmerston North	26	2.6	37.3
Wairarapa	18	4.0	31.7
Wellington	90	4.5	49.6
Wanganui	38	5.1	46.2
Southland	83	6.0	54.4

With caveats attached to this data with respect to its true representation of longstay events, three different situations can be discerned:

- (1) requirements for prolonged hospitalization occur very infrequently, admissions are few in number but those contribute to a sizeable proportion of a population's stay in hospital, e.g. Bay of Plenty, Canterbury or Waipawa;
- (2) very long stay events occur more regularly, there may be several discharges per annum depending on board size but these still account for only a small proportion of total annual discharges, e.g. Tauranga, Taranaki or Auckland; and
- (3) very long stay events are a common admission type and may be a characteristic of local hospitalization practices, e.g. South Otago, Wanganui and Southland.

Confirmation of this latter case which is inherently the most interesting requires greater investigation than can be facilitated through this analysis.

## APPENDIX D

### D.1 TECHNICAL NOTES TO CHAPTER EIGHT

#### (A) Socio-Demographic Factors

##### (1) Age Factors

Age structure of board populations were derived using the New Zealand Resident population only in 1986 with total populations being used in 1976 and 1981. Age breakdowns by five year age groups for the New Zealand Resident population were unavailable in 1976 and 1981. Given that the age structure of the board areas was defined by the 5 board age classes representing the proportion of the population aged from 0-14, 15,24, 25-44, 45-64 and 65 years and above, use of the total population in 1976 and 1981 would have had a negligible influence on the results, especially since the two populations differ little in most board areas.

The two age variables included in the analyses were:

AGE1 = % of an area's population aged 45-64 years

and: AGE2 = % of an area's population aged 65 years and above

These were chosen to represent the degree to which an area's population was middle-aged and elderly. Inclusion of the former age category in addition to the standard variable on age (AGE2) was considered important given the epidemiological characteristics of

diabetes and the age-specific patterns of hospitalization that emerged at the national level. Inclusion of all age categories was not justified and added little to the analyses.

## **(2) Sex Ratio**

The proportion of an area's population that was female was used as the variable on sex (F). This was simply derived from the population census data and interpolated for non-census years as described above. The values were expressed as percentages.

## **(3) Ethnicity**

The variable P represents a two-way ethnic classification between those of European (and other) ethnicity and those of Polynesian ethnic origin which includes both New Zealand Maori and Pacific Island populations. P is the percentage of an area's population which is identified as having Polynesian ethnic origin. Difficulties arose with this variable as the basis for determining ethnicity changed between 1981 and 1986 censuses. Whilst the proportion of New Zealand's population that is of Polynesian ethnicity has certainly increased between these two census years, the increases evidenced in the data presented in the chapter may be artificially inflated by a change in definition.

As the census publications document, ethnic origin is not used with any exactness rather the classification is based on geographic origin, descent and common social, cultural and ethnic characteristics. Up to and including 1981, inclusion in an ethnic

group was based on the criteria of half or more origin with cases of half origin being assigned on a priority basis. Changes in the classification of mixed origins resulted in the dropping of the concepts of fractional origin and priority racial groups. In 1986 a self-determinant basis was introduced where individuals are classified as of one, two or three ethnic origins according to their own specification.

In an attempt to ensure greatest comparability between census data the percentage of the population specifying ethnicity as solely European or other (including Chinese and Indian) was calculated, and P representing the proportion of Polynesian ethnicity, taken as the difference. Since the Polynesian population is at greater risk to diabetes, and perhaps diabetes hospitalization, it was appropriate to use this indicator rather than the degree to which a population was European in ethnicity. Figures were summed where necessary over constituent counties to get percent Polynesian for entire hospital board regions.

#### **(4) Education**

The level of education attained by an area population was measured as the percentage of the area population aged 15 years and over having past attendance at tertiary education institutions. Tertiary qualifications are those gained since leaving school and include all completed certificates, degrees or diplomas from universities, teacher colleges, polytechnics/technical institutes, or other tertiary institutions, regardless of the purpose or nature of the

qualification (e.g. educational, vocational, personal interest). Again data was ascertained by constituent counties in 1976 and 1981.

### **(5) *Income***

Median income of males aged 15 years and over was taken as a measure of area wealth. Income was defined as gross income before tax derived from wages, salaries, interests, dividends etc or net income before tax from own business. Prior to 1986, this excluded income derived from social security benefits, but in 1986 income also included social welfare payments such as national superannuation or family benefit.

Median income was calculated in the following manner. The median of the number of persons specifying their income was identified. Persons with no income were included in the calculations. The income class in which the median person fell was then identified. It was assumed that persons recorded in each income class were evenly distributed within that income class. The median income level was assumed to be at the same position between the lower and upper limits of the income class as the location of the median person in terms of the total number of people identified in the income class in which the median fell. For example, if the median person was located 75% of the way through the income class \$8,000-\$10,000 then the median income equalled  $\$8,000 + 0.75 \times 2000 = \$9,500$ . Income levels were calculated for each board area from constituent counties for the census years, and interpolated for the inter-census periods.

## (6) *Standardized Mortality Ratio (SMR)*

SMR was used as a general indicator of area health status. It provides a summary of death rates through which areas with high or low levels of mortality can be identified. The age adjusted indirect method of standardization was used to calculate SMR's for each board area. SMR is essentially the ratio of the number of observed deaths in an area to those expected from a standard set of death rates. The indirect method applies the standard set of age specific death rates to each board area's age distribution (Kleinman, 1977) in the following manner:

$$SMR_i = \frac{d_i}{\sum M_j p_{ij}}$$

where:  $SMR_i$  is the standardized mortality ratio for area i  
 $d_i$  is the total number of observed deaths in area i  
 $M_j$  is the death rate of age group j for the standard population  
and:  $p_{ij}$  is the population in age group j in area i

The standard population was the usually resident New Zealand population and five age groups 0-14, 15-24, 25-44, 45-64 and 65 years and over were used. The national age-specific death rates were then applied to the regional populations and the expected number of deaths calculated. SMR was then determined as the ratio of observed to expected. Mortality data was extracted from NHSC annual publication series "Mortality and Demographic Data" for individual

years with the exception of 1986 for which data had not as yet been released.

**(B) Factors of Medical Resource Availability**

**(1) *Hospital Bed Supply***

See Appendix D.2.

**(2) *Supply of Specialists***

This variable measured the number of specialist full-time equivalents employed in public hospital (non-administrative) practice per 10,000 population. There are some problems in the definition of a specialist but essentially a specialist is a doctor who by virtue of postgraduate training, examination and experience has been admitted to the membership of a college (or professional association of specialists). The specialist work-force was not broken down by area of specialty interest since numbers of practitioners are small, and since diabetic patients are cared for by a variety of specialists, usually without consultation from physicians with specialty interests in diabetes.

Since doctors have multiple work tasks, the total supply of specialists in an area was not indicative of the availability of specialist medical hospital inpatient care. Full-time equivalents (FTE) employed in non-administrative public hospital practice were therefore used as the measure of supply. Data was available from 1982 to 1985 inclusive for this categorization. Supply in 1980 and



1981 was estimated from the total number of specialists working in each area. Adjustments were based on the area relationships between the total availability of specialists and the proportions working full-time in non-administrative hospital practice for the years 1982-1985.

### **(3) *Supply of General Practitioners***

Unlike the specialists, insufficient information was available to derive supply rates based on FTEs for most years in the study period. Instead, the numerator of these per capita rates was the number of registered primary care physicians who identified their main work area as general practice. In 1980, the total number of FTEs equalled 92% of all those working in general practice, and in 1985 90%. Doctors in the smaller boards typically spend a higher proportion of work time in their general practice. As above, data was available only for the period 1980-1985. Data in the closest year was used as surrogates for the missing data.

Data for both medical work-forces were extracted from the Department of Health's Blue Book Series, New Zealand "Medical Manpower Statistics" and more recently "New Zealand Medical Workforce Statistics" issued by NHSC. Full publications were produced for 1980 and 1983, and data supplements released for 1981 and 1982, and 1984 and 1985. Statistics are obtained from the Medical Council's man-power questionnaire which is issued with application forms for annual practising certificates. Unfortunately, the selection and format of the data released has not always been consistent between years, hence the choice of the two measures outlined above.

#### **(4) *Provision of Diabetes Services***

The aim of including variables on diabetes services was to provide a broad categorization of the availability of specialist ambulatory diabetes services in each board area. As stated in Chapter Six, these services essentially comprise diabetes outpatient clinics and diabetes education services, the latter being provided by a diabetes nurse educator in relative isolation or by a diabetes health care team. Areas were classified for each of the years as: 1 = "good" service provision which includes the availability of "well-developed" clinic and education facilities; 2 = "mediocre" which usually defines the availability of only one of the services, most typically the appointment of a diabetes nurse educator. Areas were also assigned a value of 2 if one of the two services were only newly introduced and therefore not well-established; or 3 which indicates either no services are available whatsoever or a diabetes nurse educator is a new appointment. She is frequently employed on restricted hours with little back-up support, and can therefore only provide a limited range of services. Whilst this is a subjective categorization, it does serve to represent the extent to which diabetes services are developed in each area. Areas were assigned a value based on information supplied by the New Zealand Society for the Study of Diabetes, from the National Hospital Guidelines on Diabetes Services contact with regional diabetes personnel especially diabetes nurse educators, and from personal knowledge of diabetes service provision with respect to both the history of development and range of activities undertaken.

This categorization of areas was then operationalized through the use of two dummy variables D1 and D2. As stated in the text of Chapter Eight, dummy variables are assigned a value of 0 or 1 depending upon whether or not an observation has a particular attribute (Draper and Smith, 1966; Yeates, 1974). D1 defines category 1 and D2 category 2. Thus an area scores 1 for D1 if it has both types of diabetes services available (i.e. it falls into category 1) and 0 if it does not. Similarly, if an area is classified as category 2 then D2 = 1, and 0 if it does not. Since these are mutually exclusive categories, all areas with no specialist services (i.e. category 3) are defined through the delimitation of categories 1 or 2. The classification, hence, becomes:

category 1	D1 = 1, D2 = 0 both service types
category 2	D1 = 0, D2 = 1 one service
category 3	D1 = 0, D2 = 0 none (or very limited)

## **D.2 CROSS-BOUNDARY TRAVEL AND HOSPITAL BED SUPPLY**

### **(A) General Patterns of Cross Boundary Travel for Diabetes Hospital Care**

An important and general feature of hospital utilization in New Zealand is cross-boundary travel for higher order hospital services. It is well recognized that the main teaching centres draw admissions from surrounding rural boards. The levels of hospital discharge and days stay for diabetes discussed in the text of the thesis are for the residents of each board area. The rates describe the levels of demand placed on hospital care by the different board populations but they tell us nothing about where that care was received from. Because the focus of this study is the risk of area populations to hospitalization for diabetes irrespective of where hospital admission occurs, rather than service provision, rates of hospital use are not affected by cross-boundary travel.

A geographic description of hospital use would however be incomplete without some discussion on patterns of patient flow, but more importantly, Chapter Eight aimed to explore variations in hospital use in relation to the availability of health care resources. If local populations travel outside their board area to other centres for care then they effectively increase the supply of resources that are available to them. Cross-boundary travel becomes important in identifying the levels of resources that the different populations effectively have access to. Hospital bed supply is, for example, increased over and above endogenous supply in net generating or

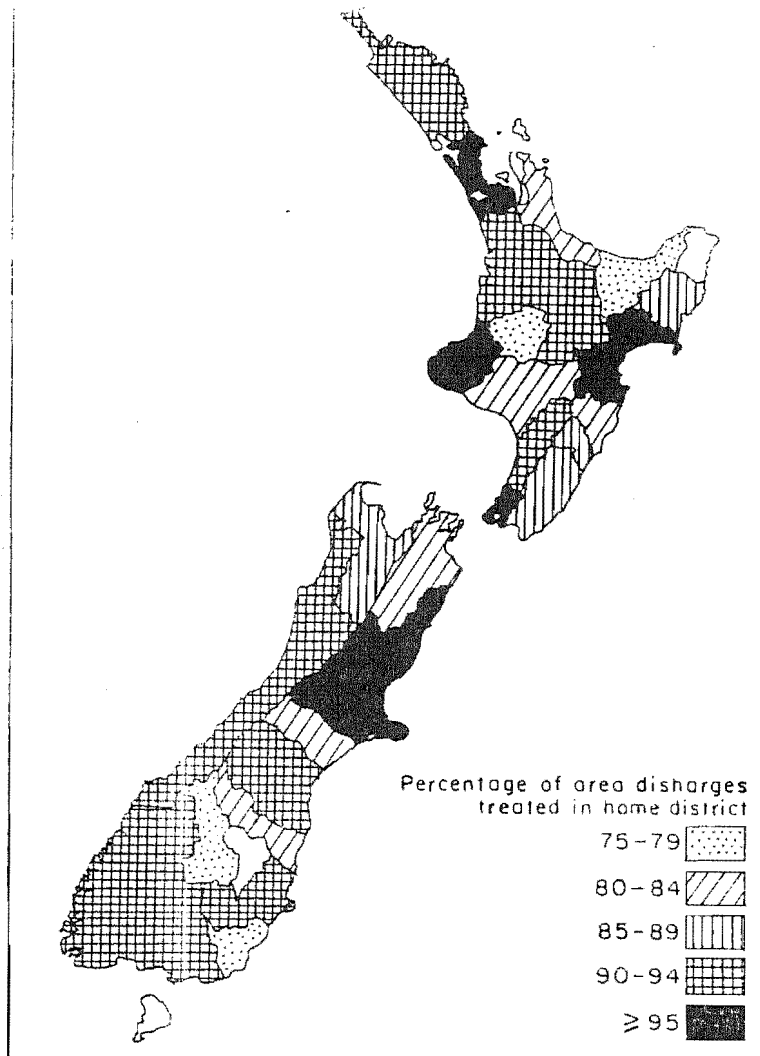
source areas of cross boundary travellers because these populations draw on resources provides in other board areas. Supply is reduced in destination areas, that is, in areas providing treatment to travellers. Fewer beds are available to the local population because these are used by out-of-board residents.

Data on cross-boundary flow was obtained from NHSC for diabetes discharges from hospital in 1982 and 1983 taken as sample years mid-way through the study period. These data are presented in Section C of this Appendix. Figures D.2.1 and D.2.2 present results for the discharge data only. These two figures illustrate the main features of cross-boundary travel in obtaining hospital care for diabetes. Figure D.2.1 shows the proportion of admissions that occur within home boards, while Figure D.2.2 shows the destinations of the primary and secondary flows of patients from each board as measured by the percentage of discharges treated in boards outside patient domiciles. Several observations can be made.

First, most patients are treated in hospitals located within their own residential hospital board district. Even in the smallest boards, over 75% of diabetes admissions occurred locally. Second, there is a strong hierarchical pattern - the proportion of patients treated in their home district increased with board size. In association with this, and thirdly, the large boards Otago, Canterbury, Wellington, Palmerston North, Waikato, Auckland, and Hawkes Bay, are not unexpectedly the key destinations acting as higher order centres for sectional catchments. Fourth, minor flows occur between adjacent boards, perhaps reflecting shortest distances to hospital services rather than accessing more sophisticated and specialist forms of

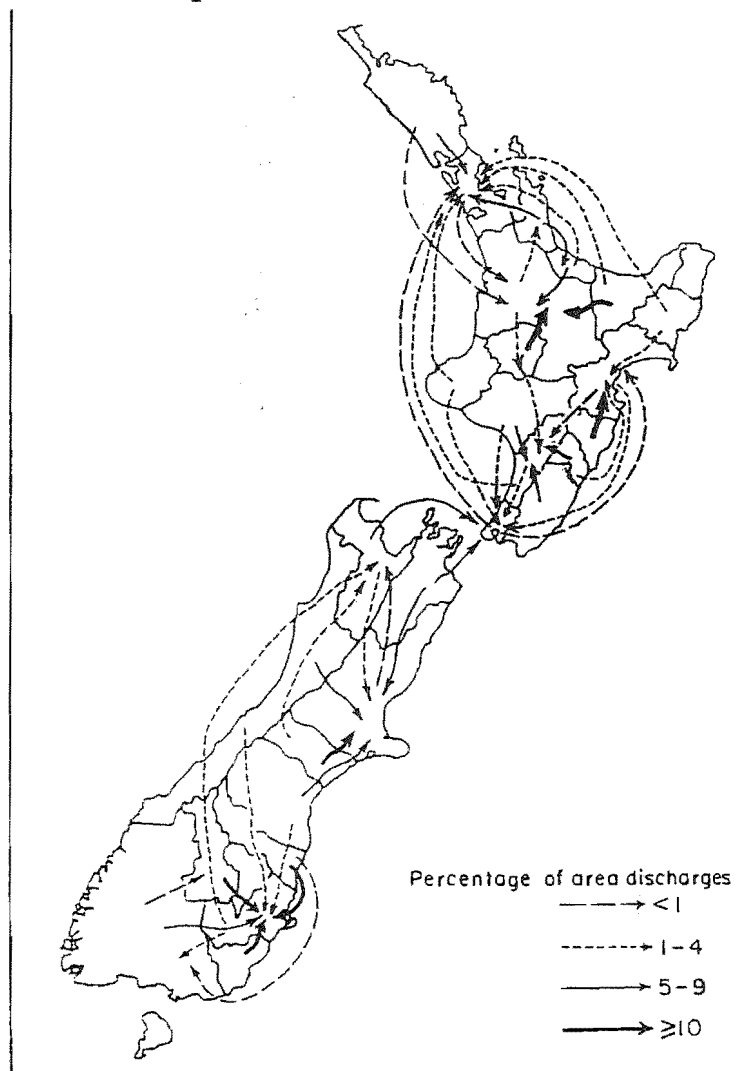
**Figure D.2.1:**

Discharges Treated in Hospital Board District of Patients Domicile (1982-1983).



**Figure D.2.2:**

Primary and Secondary Cross Boundary Flows for Diabetes Hospitalization.



care. For example a small proportion of Southland residents were treated in Vincent.

Finally, some patients are admitted to hospital outside of their home district through chance happenings, falling ill when on holiday or on business for example. In 1982 and 1983, a total of seven Otago, Ashburton and Canterbury residents were hospitalized in Nelson, a popular summer holiday area among South Islanders (thus giving rise to the depicted flow patterns). An examination of the duration of stay for these events, indicates that they are of a very short nature suggestive of "accidental" admissions. Chance events are in most cases readily discernible because they are isolated incidences occurring in areas somewhat distant from an individual's place of normal domicile. They do not represent set demand by an area on outside resources, but are important from the host board's point of view in terms of the overall use of their resources.

#### **(B) Determination of Hospital Bed Supply**

The number of hospital beds available to each area was determined using the census population approach as described by Barnes (1982) and outlined as follows. The matrix in the table below is composed of rows identified with hospitals and columns identified with the area of discharged patients. The body of the table displays counts of patients discharged from hospital  $i$  to a residence in area  $j$ . Column 7 gives the total discharges from each hospital and the total discharges to each area are given by the sum of each area column. A fraction of the total discharges from a hospital (given in column 7)

**TABLE D.2.1**  
**METHODS OF ALLOCATING RESOURCES ON A PER-CAPITA BASIS**

Hospital (i)	Area (j) of Residence of Discharged Patients:					Total Discharges From Hospital	Fraction of Total Discharges from Hospital Residing in Area j	Fraction of Resources R <sub>j</sub> of Hospital Allocated to Area j
	1	2	3	-	J			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	D <sub>11</sub>	D <sub>12</sub>	D <sub>13</sub>	-	D <sub>1J</sub>	D <sub>1.</sub>	D <sub>1j</sub> /D <sub>1.</sub>	(D <sub>1j</sub> /D <sub>1.</sub> )R <sub>1</sub>
2	D <sub>21</sub>	D <sub>22</sub>	-	-	D <sub>2J</sub>	D <sub>2.</sub>	D <sub>2j</sub> /D <sub>2.</sub>	(D <sub>2j</sub> /D <sub>2.</sub> )R <sub>2</sub>
3	D <sub>31</sub>	-	-	-	-	-	-	-
....	-	-	-	-	-	-	-	-
I	D <sub>I1</sub>	D <sub>I2</sub>	-	-	D <sub>IJ</sub>	D <sub>I.</sub>	D <sub>Ij</sub> /D <sub>I.</sub>	(D <sub>Ij</sub> /D <sub>I.</sub> )R <sub>I</sub>
Totals	D <sub>.1</sub>	D <sub>.2</sub>	-	-	D <sub>.J</sub>	D <sub>..</sub>		
Census								
Population of	P <sub>1</sub>	P <sub>2</sub>	-	-	P <sub>J</sub>			
Area								

$$R_i^* = \sum_{i=1}^I D_{ij}/D_{i.})R_i$$

**Note:** Total resource R allocated to area j from all hospitals is sum of column 9 = R\*; Resource rate per capita in area j = R<sub>j</sub>/P<sub>j</sub>.



may be assigned to an area  $j$ . These fractions (column 8) may be calculated for each area serviced by each hospital.

Assuming that in every hospital  $i$  the utilization of its resources or services by area  $j$  is directly proportional to the fraction:

$$\frac{D_{ij}}{D_i} = \frac{\text{number of discharges from hospital } i \text{ to area } j}{\text{total discharges from hospital } i}$$

then resources may be allocated on a per capita basis. If some resource  $R_i$  of hospital  $i$  (e.g. beds) is multiplied by the appropriate fraction designated in column 8 for area  $j$ , then the fraction of hospital  $i$ 's resource allocated to area  $j$  can be estimated, as in column 9. The total resource  $R_j^*$  allocated to area  $j$  from all hospitals is obtained by summing the entries in column 9. This total can then be divided by the area census population  $P_j$  to estimate a per capita rate of supply.

The analysis undertaken in Chapter Eight was, however, not concerned with individual hospitals but rather use of resources available from different hospital board areas. The methodology remains the same as that described above, but hospital  $i$  becomes hospital board  $i$ , i.e. individual hospitals are replaced by host boards from which treatment is accessed.

Since hospital utilization was investigated using two data sets, two bed supplies were calculated to maintain internal consistency between the independent and outcome measures. Hospital bed supply was initially defined as the number of available medical,

surgical, paediatric and geriatric beds per capita (variable BEDS). Fractions used to adjust for cross-boundary use were derived from hospital stay, i.e. each  $D_{ij}$  pertained to patient days rather than discharges. This better indicated total use of resources as it reflected bed occupancy attributable to each area. A second measure of bed supply was derived for use with the adjusted hospital stay data from which the very long-stay admission events had been removed. Geriatric beds were now excluded and bed supply related only to medical, surgical and paediatric beds (variable ABEDS). The relative use of other board resources were based on discharge fractions, assuming cross-boundary travellers had similar durations of hospital stay as patients resident in the host boards.

The matrices used to determine hospital bed supply were derived from the 1982-1983 cross-boundary flow data. The fractions used in the calculations were assumed to be constant over the study period. These were applied to the annual state bed returns to derive annual area bed supplies. Data on bed numbers were obtained from the NHSC publication series "Hospital Management Data" for each of the eight years.

### **(C) Cross Boundary Travel Data**

Data on patterns of cross-boundary flow are given in Tables D.2.2 to D.2.6. Tables D.2.2 and D.2.5 give the number of discharges and days stay by domicile of patients by hospital board district in which hospitalized. The total cumulative number of discharges attributable to each area population in 1982 and 1983 is given by row totals and the number of discharges treated in each region by column

total. In the body of Table D.2.3 are the percentages of discharges attributable to each board population by board in which treatment was received, e.g. 90% of the 321 discharges by residents of Northland in 1982/1983 occurred in hospitals in Northland, 9.7% of discharges involved treatment in Auckland and 0.3% in Waikato.

The fractions used as input into determining area bed supplies are given in Tables D.2.4 and D.2.6. These present, data by board of treatment, i.e. the figures in the body of the tables are the percentage of discharges, and patient days, treated in a given board area by patient domicile. For example, 2.4% of the discharges treated in Auckland Hospital Board area are attributable to residents of Northland, 94% to Aucklanders, or 0.5% to Waikato residents etc.

As these tables were used to identify the demand different area populations typically placed on hospital board resources, discharges which appeared to be purely random events were deleted from the bed supply calculations, and therefore not included on Tables D.2.4 and D.2.6. Only one or two events were deleted (these can be identified by cross-referencing with Tables D.2.2 and D.2.5). Exclusion of discharges depended on:

- (1) The numbers of discharges involved;
- (2) Length of Hospital stay;
- (3) Consistency between the two years;
- (4) Distance between board of patient domicile and board in which hospitalization occurred; and
- (5) National patterns of cross boundary travel for all causes.

	ROW	BOARD OF TREATMENT																												
BOARD OF DOMICILE	TOTAL	NTH	AUCK	W 1	THAM	TAUR	BOP	TAUM	W 2	COOK	HBAY	W 3	DANN	W 4	TAR	WANG	P N	WELL	MARL	NELS	WEST	CANT.	ASH	SCAN	W 5	OTAGO	SOT	VINC	MANI	STH
COLUMN TOTAL	6490	306	1319	671	111	118	107	41	20	169	353	22	26	104	354	172	249	517	54	126	157	490	67	167	60	292	37	22	2	357
NORTHLAND	321	289	31	1																										
AUCKLAND	1266	9	1240	6	4	3					1					1				2										
WAIKATO 1	650	6	7	611	8	1	2	8		1	1						1	1			1			1						1
THAMES	120		11	6	96	7																								
TAURANGA	127	1	6	9	2	106		1								1		1												
BAY OF PLENTY	123		2	23			101				1					1														
TAUMARUNUI	42			9				32									1													
WAIAPU 2	45		2						20	21	2																			
COOK	164		4	2			2			146	5						1	2								1		1		
HAWKES BAY	347		1								335						1	3	5					1		1				
WAIKAWA 3	25										4	21																		
DANNEVIRKE	30										1		26			1		2												
WAIKARARAPA 4	113													101			10	3			1	3								
TARANAKI	367		5												349	1	2	10												
WANGANUI	166															2	166	14	4											
PALM NORTH	235		4	1				1				1				1	213	11	1					1						
WELLINGTON	466	1	4	2	1		1				3			2			1	467	1	1					1					1
MARLBOROUGH	59																	5	50			3		1						
NELSON	129		1															7		116										
WEST COAST	166																				154	9		1		2				
CANTERBURY	453			1		1				1				1			2		1	2	1	441								2
ASHBURTON	63																			2		14	67							
SOUTH CANTERBURY	177																					10		161		5	1			
WAITAKI 5	70																								58	11				1
OTAGO	241																	1	1	3		2			1	225	1			7
SOUTH OTAGO	46																									11	35			
VINCENT	23																									5		18		
MANIOTOTO	4		1																							1			2	
SOUTHLAND	382																					3		1		30		3		345

**Table D.2.2:** Discharges (1982-83) by Domicile of Patients by Hospital Board District in which Hospitalized.



|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

**Table D.2.4:** Percentage of Discharges Treated in Hospital Board District by Patient Domicile: Discharge Fractions Used in Determining ABEDS.

		BOARD OF TREATMENT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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**Table D.2.5:** Days Stay (1982-1983) by Domicile of Patients by Hospital Board District in which Hospitalized.

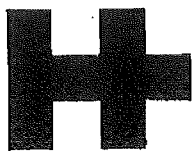
		BOARD OF TREATMENT																												
	ROW	NTH	AUCK	W 1	THAM	TAUR.	BOP	TAUM.	W 2	COOK	HBAY	W 3	DANN	W 4	TAR	WANG	PN	WELL	MARL	NELS	WEST	CANT	ASH	S CANT	W 5	OTAGO	S OT	VINC	MANI	STH
BOARD OF	TOTAL	5277	32670	12120	1881	2956	1134	1000	221	1770	4858	1718	874	1678	6611	3977	7343	12015	670	1465	4669	7660	100	3996	1190	3965	1251	210	9	8641
COLUMN TOTAL																														
NORTHLAND	5878	97.8	2.1																											
AUCKLAND	31203	0.8	95.0	0.4	1.7	0.9																								
WAIKATO 1	11584	1.2	0.4	92.1	3.0			11.2																						
THAMES	2157		0.7	0.7	94.6	2.4																								
TAURANGA	3545		1.2	2.2	0.6	95.3																								
BAY OF PLENTY	1532			3.3			96.7																							
TAUMARUNUI	940			0.4				88.8																						
WAIAPU 2	610		0.1						100.0	20.2																				
COOK	1529		0.1	0.3			0.3			78.6	0.2						0.6	0.1												
HAWKES BAY	5071										97.6						0.7	1.7												
WAIPAWA 3	1730										0.3	99.8																		
DANNEVIRKE	953										1.0		100.0				0.4													
WAIKARAPAPA 4	1832													99.1			1.3	0.2												
TARANAKI	6900		0.2												99.3		0.4	1.9												
WANGANUI	4254											0.3	97.8	4.0	0.4															
PALMERSTON NORTH	7428		0.1												0.2	0.3	92.0	5.1												
WELLINGTON	10834																88.7													
MARLBOROUGH	652																0.2	90.1			0.3									
NELSON	2001																1.5		96.0		5.1									
WEST COAST	4733																			99.9	0.7									
CANTERBURY	6984																				89.8									
ASHBURTON	1232																				1.4	100.0								
SOUTH CANTERBURY	4143																				1.3		99.2			1.0				
WAITAKI 5	1325																							98.7	3.3					
OTAGO	3368																					0.5				81.7				0.7
SOUTH OTAGO	1388																									3.1	97.1			
VINCENT	264																									1.9		90.5		
MANIOTOTO	16																									0.1		100.0		
SOUTHLAND	8913																									8.4		9.0		98.9

**Table D.2.6:** Percentage of Days Stay Treated in Hospital Board District by patient Domicile: Days Stay Fractions Used in Determining BEDS.



# APPENDIX E

## E.1 COMMUNITY ITDM SURVEY DATA SHEET



North Canterbury Hospital Board

The Princess Margaret Hospital

Cashmere Road, Christchurch 2, New Zealand. Telephone 381 452

When replying please quote

THE DIABETES UNIT of the  
DEPARTMENT OF MEDICINE

SURVEY: PREVALENCE OF INSULIN-REQUIRING  
DIABETES MELLITUS IN CANTERBURY

INVESTIGATORS: MR L.A. WOODHAM, DR R.S. SCOTT  
PROF D.W. BEAVEN, MS L.J. BROWN

DATE: \_\_\_\_\_

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

DATE OF BIRTH: \_\_\_\_\_ SEX: ☐ Male

☐ Female

FAMILY DOCTOR: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

YOUR INSULIN(s): \_\_\_\_\_

(Please ask your pharmacist for help if you are not sure)

USUAL DAILY DOSE: \_\_\_\_\_ UNITS IN THE MORNING

\_\_\_\_\_ UNITS IN THE EVENING

HOW LONG HAVE YOU BEEN ON INSULIN: \_\_\_\_\_ YEARS

HOW LONG HAVE YOU HAD DIABETES: \_\_\_\_\_ YEARS

Thank you for helping with this important research.  
Information you have given will remain confidential.

**E.2 ETHICAL AGREEMENTS**

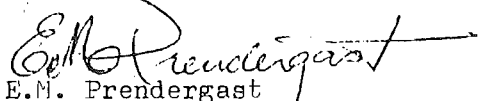
F12aA	<b>NORTH CANTERBURY HOSPITAL BOARD</b>		
	<b>TO</b>	DR. R.S. SCOTT, DEPARTMENT OF MEDICINE, T.P.M.H.	
	<b>COPY TO</b>	MR. J.W. ARDAGH, CHAIRMAN, ETHICAL COMMITTEE, H.C.H.P. MEDICAL SUPERINTENDENT, T.P.M.H.	<div>FILE REF.</div> <div>DATE 20.12.82</div>
	<b>FROM</b>	MEDICAL SUPERINTENDENT-IN-CHIEF	

**SUBJECT**PROPOSED SURVEY

The Ethical Committee has considered the proposed "Survey into the Utilisation of Health Services By Diabetic Patients" and has no objection to the study proceeding provided: -

1. Clerical staff involved are made aware of the necessity for strict confidentiality of any information found in the case notes and that this confidentiality is in fact observed.
2. The names of patients are not mentioned in the survey report.

Approval is granted for the survey to proceed on the basis of the protocol submitted provided the requirements of the Ethical Committee are met with regard to the confidentiality of information and the use of patient names in the report.



(for) E.M. Prendergast  
Medical Superintendent-in-Chief

F128A

## CANTERBURY HOSPITAL BOARD

TO  
DR R.S. SCOTT, SPECIALIST PHYSICIAN,  
THE PRINCESS MARGARET HOSPITAL

COPY TO  
ASSOCIATE PROFESSOR J.B. MORTON,  
CHAIRMAN, ETHICAL COMMITTEE  
MEDICAL SUPERINTENDENT, T.P.M.H.

FILE REF.

DATE

26.11.87

FROM MEDICAL SUPERINTENDENT-IN-CHIEF

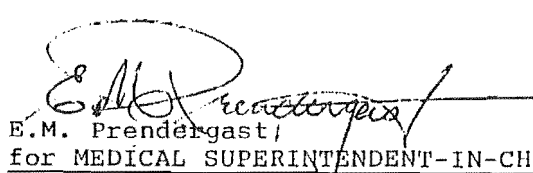
## SUBJECT

RESEARCH PROTOCOL

The Ethical Committee has considered your two research protocols entitled:

1. "Collection of an additional blood sample from all patients attending the Diabetes Outpatient Clinic."
2. "Proposal to interface the Canterbury population based Diabetes Register with the Health Department National Archives System."

The Ethical Committee has no objection to these applications and approval is given for them to proceed.

  
E.M. Prendergast,  
for MEDICAL SUPERINTENDENT-IN-CHIEF

### E.3 CHARACTERISTICS OF THE CANTERBURY INSULIN TREATED DIABETIC POPULATION

AREA	POP.	NO.	PREV.	AGE	DUR.	PROP	DISCH.
RANGIORA PART	744	9	-	22	56	13	13
KAIAPOI	5220	23	4.4	32	41	22	35
HALSWELL	5346	14	2.6	14	43	29	57
HORNBY	7695	33	4.3	25	41	30	76
SOCKBURN	6501	18	2.8	17	22	20	27
PAPARUA PT	9522	15	1.6	13	33	13	27
REDWOOD, STYX MILL	7266	12	1.7	25	25	17	17
CASEBROOK, NORTHCOTE	4317	19	4.4	26	42	44	94
SAWYERS ARMS, KAIMAHI	6963	18	2.6	28	33	22	44
HAREWOOD, BISHOPDALE	5133	21	4.1	38	30	24	52
RUSSLEY, BURNSIDE,							
WAIRARAPA, JELLIE PARK	8538	32	3.7	25	47	26	87
BRYNDWR, HOLMWOOD,							
FENDALTON, DEANS BUSH	8550	22	2.6	45	36	40	80
MERRIN, WESTBURN,							
MASHAM	8022	23	2.9	26	39	16	63
AVONHEAD, ILAM	6873	22	3.2	23	32	30	60
UPPER RICCARTON, WHARENUI,							
MIDDLETON	5427	23	4.2	43	32	55	115
BELFAST, STYX	8580	19	2.2	5	26	32	89
MARSHLANDS	4782	17	3.6	35	65	29	112
RICCARTON BOROUGH	6936	39	5.6	36	46	29	53
CASHMERE, HILLSBOROUGH,							
VALLEY	9246	39	4.2	23	38	23	1
CITY	6885	23	3.3	26	50	26	95
PAPANUI, AORANGI	7779	32	4.1	27	29	24	31
STROWAN, MERIVALE	7446	33	4.4	45	35	32	55
MALVERN, ST ALBANS	11853	47	4.0	40	45	33	85
MAIREHAU, SHIRLEY	9462	32	3.4	19	44	39	71
EDGEWARE, RICHMOND	8022	20	2.5	25	40	29	50
CHISNALL, AVONSIDE	5553	25	4.5	40	44	43	78
ARANUI, BEXLEY	8763	33	3.8	3	24	21	45
BURWOOD, WAINONI	11283	41	3.6	18	46	42	74
LINWOOD	9522	30	3.2	35	41	22	26
EAST LINWOOD, BROMLEY	4683	14	3.0	21	36	29	50
WOOLSTON, ENSORS	10047	51	5.1	22	22	24	44
OPAWA, ST MARTINS	5949	18	3.0	28	61	41	59
WALTHAM, SYDENHAM,							
ADDINGTON	8175	33	4.0	36	28	40	77
BARRINGTON NORTH, SPREYDON							
BARRINGTON SOUTH	7707	24	3.1	38	46	33	62
HOONHAY SOUTH, SOMERFIELD							
BECKENHAM	9792	27	2.8	19	23	29	54
HOONHAY, HILLMORTON	7620	28	3.7	30	48	35	42
NORTH BEACH, RAWHITI	8031	32	4.0	25	44	26	42
BRIGHTON	5988	17	2.8	35	65	29	59
MT PLEASANT, CLIFTON,							
SUMNER	8994	31	3.4	19	26	33	70
LYTTELTON	3180	10	3.1	20	30	22	22
MOUNT HERBERT PART	963	2					
RANGIORA PART	744	9					
EYRE PART	1782	2					

Pop. = area population; No. = number of ITDM persons; Prev. = prevalence per 1,000 population; Age = proportion of ITDM persons aged 65 or over; Dur. = proportion of ITDM with diabetes duration  $\geq 15$  years; Prop. = proportion of ITDM persons hospitalized 1984-1986; Disch. = number of discharges per 10 ITDM persons 1984-1986.

**E.3 Continued...****PREVALENCE OF ITDM IN RURAL CANTERBURY**

	POP	NO	PREV
KAIKOURA	3567	7	2.0
AMURI	3171	7	2.2
CHEVIOT	1362	3	2.2
HURUNUI	6495	10	1.5
RANGIORA COUNTY	5682	13	2.3
RANGIORA BOROUGH	6651	27	4.1
EYRE	1416	3	2.1
OXFORD	1896	6	3.2
DARFIELD	1065	6	5.6
MALVERN	5454	3	0.6
PAPARUA	3957	5	1.3
MOUNT HERBERT	162	1	-
AKAROA	1959	6	3.1
WAIREWA	654	2	-
LINCOLN	1854	5	2.7
LEESTON	1017	6	5.9
SOUTHBRIDGE	591	2	-
ELLESMERE	5478	12	2.2

#### **E.4 CHARACTERISTICS OF ITDM PERSONS LEAVING CANTERBURY, OR DYING, DURING THE PERIOD 1 JANUARY 1984 - 31 DECEMBER 1986.**

##### **1) OUTMIGRANTS: characteristics as at 1 January 1984**

a) N=59 persons (F=33, M=26)

b) mean age= 33.83 years, range 2 - 78 years,

age-group	frequency
0-19	13
20-39	27
40-59	11
≥60	7
(1 missing case)	

c) mean duration of diabetes = 9.7 years (SD=7.0yrs)  
range 1 - 30 years

marital status	frequency
single	23
married	25
widowed	3
divorced/ separated	2
(6 missing cases)	

e) occupational status frequency

I	1
II	10
IIIN	7
IIIM	4
IV	2
V	5
retired	11
other	3

(See Chapter Nine for definitions of classes).

##### **2) DECEASED PERSONS**

a) N=129 persons (F=62, M=67)

(at death)

b) median age =71 years, range 19- 91 years  
Only 6 persons were aged < 40 years at death

c) mean duration of diabetes =17.4 years.

(as at 1 January 1984)

d)	marital status	frequency
	single	9
	married	69
	widowed	43
	divorced/ separated	6
	(6 missing cases)	

e)	occupational status	frequency
	I	-
	II	2
	IIIN	3
	IIIM	4
	IV	5
	V	2
	retired	107
	other	3

(See Chapter Nine for definitions of classes).

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